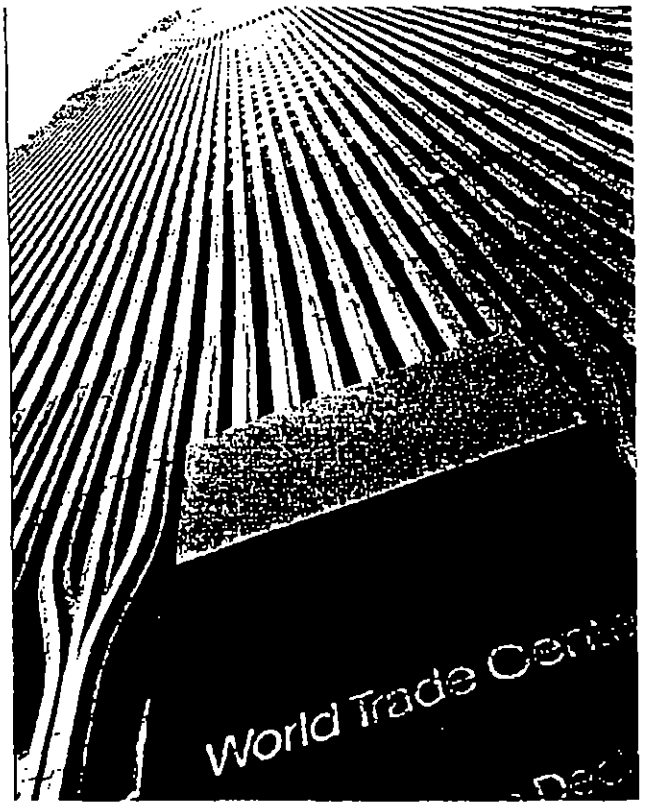
PROPERTY CONDITION ASSESSMENT
OF
WORLD TRADE CENTER PORTFOLIO



TWO WORLD TRADE CENTER

Located In

NEW YORK, NEW YORK

Prepared For

THE PORT AUTHORITY OF NY & NJ
WORLD TRADE CENTER COMPLEX
NEW YORK, NEW YORK 10048

Prepared By

MERRITT & HARRIS, INC.
110 East 42nd Street
New York, New York 10017
(212) 697-3188
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FINAL DRAFT

Property #2

Merritt & Harris, Inc. Project Number 20-251E

CD File SK012215

20-251E

December 6, 2000

Mr. Jeffrey S. Green
General Counsel
The Port Authority of NY & NJ
1 World Trade Center
New York, New York 10048

Re: Due Diligence Physical Condition Survey
World Trade Center
New York, New York

Dear Mr. Green:

Enclosed are 7 copies of our report of the conditions observed during our site visits to the referenced property between September 13 and October 31, 2000. For this report, I served as the Project Coordinator, with Peter J. Brady, P.E., as Project Manager and Structural Engineer, and Jack M. Kagan and Joseph Marciano, P.E., as Mechanical/Electrical Engineers.

As previously agreed, Merritt & Harris, Inc. has divided the report into 7 segments as follows:

1. One World Trade Center (Tower A)
2. Two World Trade Center (Tower B)
3. Retail Mall and Plaza
4. Four World Trade Center (Southeast Plaza Building)
5. Five World Trade Center (Northeast Plaza Building)
6. Central Services
7. Subgrade

For convenience, identical copies of Sections I - IV (I - Identification, II - Objective, III - Procedures and Limitations, and IV - Executive Summary) have been included with each report so they can stand independently, if required to do so.

Thank you for selecting Merritt & Harris, Inc. as your consultant on this project. If you have any questions, please call me.

Very truly yours,

MERRITT & HARRIS, INC.

Robert G. Weiland, R.A.
Vice President & Principal

RGW:rw
Enclosure

cc: Thomas C. Richard
Peter Brady
Jack Kagan
Joseph Marciano

REPORT OF
DUE DILIGENCE PHYSICAL CONDITION SURVEY
WORLD TRADE CENTER

Located At

WORLD TRADE CENTER COMPLEX
NEW YORK, NEW YORK

Prepared For

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY
1 WORLD TRADE CENTER
NEW YORK, NEW YORK 10048

Prepared By

MERRITT & HARRIS, INC.
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NEW YORK, NEW YORK 10017-5685

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7. Subgrade

SECTION I - IDENTIFICATION

Project Name: World Trade Center

Location: One - Five World Trade Center
New York, New York 10048

Report Prepared For: Mr. Jeffrey S. Green, General Counsel
The Port Authority of NY & NJ
1 World Trade Center
New York, New York 10048

Site Visits and Report By: Thomas C. Richard, AIA
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Merritt & Harris, Inc.

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Project Coordinator
Merritt & Harris, Inc.

Peter J. Brady, P.E.
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Elevator Field Engineer
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William G. Young, P.E.
Facade Consultant
Heitmann & Associates

Wayne Crandlemere
Environmental Consultant
Crandlemere & Associates

Port Authority Personnel Present During Visits:

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Dates of Site Visits: September 13 - October 31, 2000

SECTION II - OBJECTIVE

The purpose of the on-site evaluation and document review is to assess the general physical condition of the property as it currently exists. This report provides a narrative and photographic description of the buildings, as well as a listing of any deficiencies that were noted during our site visit.

The report has been divided as follows into seven component sections for ease of handling:

1. One World Trade Center (Tower A)
2. Two World Trade Center (Tower B)
3. Retail Mall and Plaza
4. Four World Trade Center (Southeast Plaza Building)
5. Five World Trade Center (Northeast Plaza Building)
6. Central Services
7. Subgrade

Each of the volumes contains descriptions of the component, recommendations for items requiring action, and photographs and supporting documentation specific to each component of the project. An overall Executive Summary, identical for all volumes, has been reproduced and included in each of the volumes for convenience. Shared site feature and service elements are described and discussed within the Executive Summary section. Due to the nature of the project, some of the construction elements may be shared or physically interconnected among 2 or more of the project components. As a result there may be some redundancy noted in the report in order to indicate the support of 2 or more project components by these systems.

The Recommendations section for each volume is a listing of items that will require action within the next 10-year period. **Immediate (0-1 Year)** issues are deficiencies which are in violation of codes, which pose a danger to public safety, or which, if left uncorrected, will lead to further deterioration of the property or significantly impact marketability or habitability. Issues that will require addressing during the second to the tenth years are divided into 2 categories, **Future (1-5 Years)** and **Future (6-10 Years)**. These categories represent work not required by agencies or codes, but which, in our opinion, are issues that should be attended to in the context of the prudent management of the property.

ADA compliance work is considered to be mandatory and is listed separately.

SECTION III - PROCEDURES AND LIMITATIONS

To adequately determine the present conditions at the World Trade Center (WTC), Merritt & Harris, Inc. performed on-site observations between September 13 and October 31, 2000. Mr. Leandro Zucchi, Assistant General Manager, Building Services Management of the Port Authority, acted as the Project Coordinator, arranging security clearances, providing knowledgeable escorts for the various components of the project, and facilitating review of available documentation. Over a period of several weeks, our field personnel physically observed the buildings, reviewed documentation, and interviewed Port Authority personnel regarding building conditions, operations and maintenance procedures, and capital projects.

Because of the physical complexity of so large a project, the separation of individual systems into definable areas for inclusion in the reports of the various buildings was not easily achieved. While we have attempted, with the assistance of Port Authority personnel, to assign systems to their associated buildings, the assignments are based on our opinion, with input from the Port Authority, of where the systems logically fall. As the division of buildings and systems into individual entities was never planned or previously assigned, any attempt to separate the buildings and systems for individual transactions should be carefully studied and documented. As we understand from the Port Authority that the WTC transaction will be accomplished by treating the complex as a single entity, the division of buildings and systems in this report has been done to clarify the reporting and simplify the task of reading so large a document.

Merritt & Harris, Inc. selectively reviewed documentation available in the WTC Data Center, located on the 3rd floor of 5 WTC. Merritt & Harris, Inc. focused on those items relating to the physical buildings, and did not review such items as financial reports and leasing documentation. The primary documentation used by Merritt & Harris, Inc. was from the following categories in the Checklist Items:

A. General Property Information
D. Environmental Information (Note that this information was not in the Data Room, but was provided to Mr. Crandlemere in the Port Authority office of Mr. Phil Taylor)
E. Operating and Maintenance Manuals
I. Structural Integrity Inspection Reports
J. Facades
K. Mechanical Reports/Information
L. Vertical Transportation Profile & Inspection Reports
M. Electrical Reports
N. Blast Related Reports/Information
O. Life Safety Code Analysis

Attachment 3 is the Due Diligence Checklist, or listing of available documents as of October 31, 2000.

In addition, a set of original construction documents was available on CD ROM format. A selective review of these drawings was done to familiarize our staff with the basic building layouts, material selections, and design criteria. Due to the volume of documentation available, an exhaustive plan, specification and code review of this property was not performed. Merritt & Harris, Inc. accessed these documents in an attempt to clarify issues raised by observations in the field or to further research references to building components mentioned in the reports by other consultants available in the Data Room.

Our observations were limited to those portions of the project that were visible during the walk-through. In many areas, building finishes concealed structural components from view. Merritt & Harris, Inc. neither took material samples nor performed tests on the building materials or systems. Our investigation of the building facades was performed from ground level and from the roofs.

Some equipment observed was not operating during our visit due to seasonal requirements. No attempt was made to operate the equipment as the facility was occupied and appropriate climate control was required. In the case of idle machinery or equipment, our opinions were formed by interviewing available personnel and reviewing any maintenance records presented to us. In order to be as fully apprised as possible of the operating condition of the major pieces of machinery, a Mechanical Contractor should be retained to start the equipment and witness its operation over a period of time.

While the Port Authority does have a basic emergency plan for dealing with flooding on the property, there is no existing control method to prevent catastrophic flooding of the subgrade levels up to level B-2 due to the total flooding of the PATH tubes. Pockets for control doors were built into the perimeter slurry wall, but doors were never installed, as this method of protecting the building would pose a life-safety threat to trains and passengers in the PATH tubes. The complexity of this problem and the specific expertise needed to address the issues is beyond the scope of competence of Merritt & Harris, Inc. and has not been addressed in this report.

It is not the intent of Merritt & Harris, Inc. to assume any part of the design responsibility, but rather to report our findings to our Client to whom this report is addressed. It is further understood that as building maintenance is ongoing, some areas of concern noted in this report may have been addressed subsequent to our site visit and may no longer be applicable.

The square footage areas used in the following sections are as provided in the J.P. Morgan Offering Memorandum, dated June 21, 2000 (the Offering Memorandum), and in the J.P. Morgan Property Book, dated June 21, 2000 (the Property Book). Independent field measurement of buildings and/or tenant spaces or plan takeoffs is outside the scope of this assignment.

On behalf of the Client, Merritt & Harris, Inc. engaged an independent consultant to conduct a **Phase I Environmental Site Assessment and Asbestos Audit** at the site in conjunction with the due diligence. The survey was conducted by members of the staff of R.W. Crandlemere and Associates, Inc. (Crandlemere) of Weymouth, Massachusetts. The survey included visual observations of the site and buildings, and the accumulation and review of available documentation pertaining to asbestos, hazardous waste, and electromagnetic radiation generated by the roof-mounted communications transmission equipment. Crandlemere took no samples and made no physical tests. The results of the survey and any associated recommendations are contained as attachments to this report. Merritt & Harris, Inc. assumes no liability regarding asbestos audits, hazardous or toxic material monitoring, surveying, or reporting and cannot be responsible for the

work or opinions of other independent consultants engaged to do so. Merritt & Harris, Inc. reviewed the subconsultant's report and extracted summary information for inclusion within our narratives for the convenience of the reader. The environmental subconsultant's reports are provided as attachments to the individual building reports and in their entirety in Attachment 6 (separate binder) of this portion of the report.

On behalf of the Client, Merritt & Harris, Inc. engaged an independent consultant to conduct an **Elevator Review** at the site in conjunction with the due diligence. The survey was conducted by members of the staff of The BOCA Group International (BOCA) of New York, New York. The survey initially included visual observations of a pre-selected random sampling of 21 elevator and escalator devices at the buildings, and the review of available documentation pertaining to elevator maintenance and modernization programs. The sample elevators selected for observation were chosen to provide a representative specimen from each building and zone and included modernized, partially modernized, and original elevators. Following the initial sampling, BOCA further reviewed and observed additional devices based on callback data provided by the Vertical Transportation Department and on reports prepared by the Port Authority's independent elevator consultant. The reader should note that a bank of elevators (18-23B) was involved in a recent run-by incident. These elevators were not observed and have been excluded from our review to avoid interference with an ongoing legal investigation. The tenant-owned and operated elevators and escalators were not observed and do not form part of this report. Merritt & Harris, Inc. reviewed the subconsultant's report and extracted summary information for inclusion within our narratives for the convenience of the reader. The subconsultant's reports are provided in their entirety as attachments to the individual building reports.

On behalf of the Client, Merritt & Harris, Inc. engaged an independent consultant to conduct a **Curtainwall Investigation** at the site in conjunction with the due diligence. The survey was conducted by members of the staff of Heitmann & Associates, Inc. (Heitmann) of New York, New York. The survey included visual observations of the facades from interior spaces, grade level, and roofs of the buildings, and reviews of available documentation pertaining to the exterior wall maintenance and inspection programs. Heitmann personnel did not ride or descend on any scaffolding or rigging to observe the exterior walls. Merritt & Harris, Inc. reviewed the subconsultant's report and extracted summary information for inclusion within our

narratives for the convenience of the reader. The subconsultant's reports are provided in their entirety as attachments to the individual building reports.

The Merritt & Harris, Inc. assignment included a general review of the building's compliance with Title III of the Americans with Disabilities Act (ADA). Items of nonconformance are cited without regard for whether or not they are, by ADA definition, readily achievable. Factors to be considered in determining whether or not an action is readily achievable include the nature and the cost of the action needed, the overall financial resources of the operation, and the number of persons employed at the site. The decision as to which actions are to be undertaken rests, therefore, with the building ownership in consultation with its accountants, lawyers, and architects. Our general observation of the property's ADA status and related comments is not intended, and should not be construed, to replace a full ADA audit and report.

As stated in the Offering Memorandum, "The Port Authority is a municipal corporate instrumentality and political subdivision of the States of New York and New Jersey which provides transportation, terminal, and other facilities of commerce within the Port District. As such, in connection with the Transaction, the PA will continue to maintain exclusive jurisdiction with respect to certain administrative and governmental matters involving the Complex, including compliance with building, environmental, fire and health codes." The New York City Department of Buildings has indicated to our personnel that they do not maintain any records of violations for this property. A request for a Property Profile Overview for this block and lot number yields no records. The Fire Department provides normal fire fighting and a life safety service to the facility. A Memorandum of Understanding exists between the Port Authority and the Fire Department in which the Fire Department performs regular inspections and directly notifies the Port Authority Fire and Life Safety group of deficiencies to be corrected. Under a protocol with the New York City Fire Department, Port Authority Police personnel investigate certain fire alarms at the World Trade Center rather than transmitting such alarms to the New York City Fire Department.

The Merritt & Harris, Inc. report is intended for the use of the General Counsel of the Port Authority.

SECTION IV - EXECUTIVE SUMMARY

Project Scope

Property Components

The subject property consists of a 6-building complex (4 office buildings, a separate government office building, and a hotel) constructed on top of a 2-level retail mall and a 6-level Subgrade development. The Subgrade contains an underground parking garage, loading docks, storage facilities, and central mechanical and electrical services for the overall property. The Hotel, the New York Marriott World Trade Center (3 WTC), and the governmental office building, the Customs House (6 WTC), are not included in the transaction and, therefore, are not included in the scope of the Merritt & Harris, Inc. assignment or this report. The complex is located in the Financial District of downtown Manhattan, New York City and was completed in phases between 1970 and 1977. The following area summary information is taken from the Offering Memorandum and Property Book.

Building	Year Built	Gross Sq. Ft.	Remeasured Sq. Ft.	Rent Roll Sq. Ft.
One	1970	4,761,416	4,468,634	4,358,604
Two	1972	4,761,416	4,470,598	4,173,612
Four	1977	462,738	505,670	470,978
Five	1975	581,238	632,782	612,958
Subtotal Offices		**10,566,808**	**10,077,684**	**9,616,152**
Retail	1970	614,901	440,327	427,448
Total		**11,181,709**	**10,518,011**	**10,043,600**

Common Site Features

The following site features are common to all of the 7 Property Components:

Legal Description

Block 58, Lot 1

Zoning District

C6-4, C5-3

Easements and/or Encroachments

A property survey is reportedly being prepared, but was not yet completed at the time of this assignment. Our investigation of other documentation and interview of various Port Authority personnel during this assignment have yielded certain information about possible easements or encroachments.

The site is shared by 6 buildings and the retail mall. The Marriott Hotel (WTC 3) and the Customs House (WTC 6) are outside the scope of this transaction; however, there are known interconnections of services and access to shared facilities.

Conventional utility company easements are assumed. In addition there are public rights-of-way for the New York City Transit Authority subways and the PATH rail system throughout the complex.

Interconnecting bridges to three adjacent properties (130 Liberty Street, 2 World Financial Center, and 7 WTC) are reportedly the responsibility of the adjacent owners. There are, however, certain physical connections such as foundations, and service connections such as electrical power services that may be subject to easement or covenant agreements.

The WTC complex also includes a remote river water pumping station, west of West Street in Battery Park City. This station is located under the Plaza near the marina at the Hudson River and Liberty Place. The interconnecting river water loop piping runs underground from the pump station, east along Liberty Place, then north along the west side of West Street, and then eastward across West Street entering the complex at 1 WTC. There is also a river water return out-fall which occurs underground behind the sea wall near the adjacent 2 World Financial Center.

Size/Layout

The site is trapezoidal in shape and contains 15.65 acres. The site is bordered by Vesey Street on the north, Church Street on the east, Liberty Street on the south, and West Street on the west. The Marriott Hotel and the Customs House are excluded from the disposition; however, the land leased for those properties is included in the total site area noted.

Topography

The site slopes gradually downward from the east, where the street grade is roughly equal to Plaza Level, towards the west where the street grade is at Concourse level. The constructed Tobin Plaza, in the central area of the site, is accessed by gently sloped ramps up from Church Street, and by exterior stairways and escalators from the other streets.

Flood Plain

The bulk of the site towards the east side is located in Flood Zone C, an area of minimal flooding outside the 500 year flood plain as indicated on the National Flood Insurance Program Flood Insurance Rate Map, Community Panel Number 360497 0054B effective November 16, 1983. Two areas at the midpoint of the north and south boundaries are within Zone B, areas between the limits of the 100-year flood and 500-year flood, and the western edge of the site is within the 100-year flood zone. While the Port Authority does have a basic emergency plan for dealing with flooding on the property, there is no existing control method to prevent catastrophic flooding of the subgrade levels up to level B-2 due to the total flooding of the PATH tubes. Pockets for control doors were built into the perimeter slurry wall, but doors were never installed, as this method of protecting the building would pose a life-safety threat to trains and passengers in the PATH tubes.

Geological Hazards

The site is located in UBC Seismic Zone 2a, an area of minimal seismicity.

Service Utilities

A complete site survey is in the process of being compiled, but was not available at the time of this report. The information contained in this report is based upon a combination of directly observed utilities and information contained in other reports. In this way, the exact number and size of the utility services has not been included.

Electric - Consolidated Edison (New York Power Authority)
Steam - Consolidated Edison
Gas - Consolidated Edison
Water and Sewer - City of New York
Various telecommunications carriers

Underground Irrigation System	None
Access	Pedestrian access is provided at grade on all four bounding streets of the complex and from the central Tobin Plaza. The project also has direct interior access to NYC subway systems (five interior access points to 3 separate subway lines) and the interstate PATH mass-transit systems. Vehicular access for automobiles is limited to pre-screened tenants on a rental basis, to selected Port Authority employees, and to contractors having an agreement with the Port Authority for parking privileges. There are 4 ramps for access to the automobile parking areas; 1 entrance and 1 exit ramp (Ramps B&C) on the north end of the property on West Street, an exit ramp (Ramp D) on the south end of the property on West Street, and an entrance ramp (Ramp H) on the west end of the property on Liberty Street. These ramps are protected by guard station checkpoints and Delta barriers, which are mechanically operated barriers, which swing up out of the pavement to physically block the ramp. Delivery access is by means of a ramp from Barclay Street, one block north. This ramp passes under an adjacent building, 7 WTC. It is protected by a security checkpoint.
Paving	Surrounding streets are paved with asphalt. Parking ramps are concrete.
Sidewalks	The sidewalks surrounding the complex are generally exposed aggregate concrete, with some areas of granite paving that have been installed to accent building entrances.
Curbing	Curbs at the roadways are steel.
Plaza Deck	The Plaza is a granite surfaced reinforced concrete deck with a bituminous waterproof membrane. Areas of the perimeter of the deck, particularly under the building overhangs of 4, 5, and 6 WTC remain the original concrete with exposed aggregate surface. Expansion joints occur at the perimeter of each of the Tower buildings, and along the east side of the Plaza at the high end of the Church Street entry stairway and ramps.
Deck Drainage	The Plaza generally pitches towards the central area near the fountain where the runoff is collected by a circular trench drain surrounding the recessed fountain area.

Landscaping

Sidewalk wells, with cast iron gratings, framed in red granite pavers are provided for street trees along the Liberty, Church and Vesey Street sidewalks. Raised planters with shrubs and annual flowers separate the central stairway from the 2 ramps at the Church Street entrance to Tobin Plaza. All other plantings are contained in monumental sized concrete planters that also serve as security barriers to prevent unauthorized vehicular access. Other street furniture includes concrete benches and concrete and stainless steel security barriers in sculptural shapes.

Site Lighting

City street lighting on perimeter sidewalks, newly installed site lighting from the roof line of 4 and 5 WTC, and pole-mounted, multiple-lamp fixtures on the Plaza.

Fencing

Some rollaway security gates are provided at the base of exterior stairways to prevent unauthorized after-hours entry.

Amenities/Special Features

The major site amenity is the central Austin Tobin Plaza, a public space enclosed by the 6 buildings that make up the complex. The Plaza focuses on a central fountain and sculpture, representing the sun and its outward flowing rays. The Plaza is the focus of formal and informal activity during the warm weather months, when outdoor music, street vendors, and seating for the Plaza Level restaurant tenants all contribute to the life of the space. A smaller "Memorial Fountain" commemorating those who lost their lives in the terrorist bombing, is located at the west side of the Plaza between 1 WTC and the Hotel building. The Plaza is reportedly closed down in the winter months to prevent potential injury to pedestrians by the possibility of ice falling from the Towers.

The asphalt-paved area to the east of the site has recently had benches and planters installed, adding more outdoor seating for public use. A covered performance stage was installed in this area during the past summer for the Plaza's summer music program. A temporary "Green Market" is also one of the seasonal features used to draw street traffic to the site. Some sections of this area have at times been used for special parking requirements.

Signage

There is a polished stainless steel monolith with a bronze plaque and a red numeral designation at the main entrance door for each of the buildings in the complex. Additional exterior signage is building installed.

Mall entrances are marked with back-painted signs on the glass transoms above the entrance doors. Retail tenants with exterior exposure have window-mounted signage. Major commercial office tenants have signage on some of the entrance door transoms. Awnings with Mall signage have recently been installed at Mall entrances.

Ancillary Structures

The river water pump station is located about one block west of the site at Liberty Place and the Hudson River. It is an underground structure beneath the pavement of Battery Park City Plaza. It is included in the Central Plant Report.

There are some minor kiosk installations for bus shelters, street vendors, and taxi cab dispatchers around the site.

Project Condition

The buildings were originally constructed of good quality materials. The overall present condition of the property is good. However, as with any large complex of this age, ongoing repair and maintenance should be expected to be required.

Site

Site improvements are adequate and appropriate for a project of this size and status. The majority of the Plaza, which serves as the roof for the retail mall, was resurfaced in red and gray granite during the Plaza rehabilitation of 1998-99. The fountain was rehabilitated and made fully operational. New benches and planters were installed. The membrane waterproofing beneath the old pavement was probed and found to be functioning well. In general, the concrete sidewalks around the site perimeter are sound without tripping hazards, but there has been spalling and cracking over the years that is beginning to lead to an unattractive appearance. A 1999 study of the sidewalk conditions was performed by M.E.D.D, a unit within the Port Authority Engineering Department. M.E.D.D. included several recommendations for upgrades; however, there has been no decision to proceed with any of the work at this time. Plaza areas outside of the new granite surface have varying degrees of deterioration. However, the repairs have not been implemented pending the coordination of pavement repairs with the possible extension of retail areas under the building overhangs of 4 and 5 WTC. Pavement replacement is in progress along the West Street side of the site adjacent to the Customs House as a separate project under the auspices of the U.S. General Services Administration.

Structural

The building structures appear to be in adequate overall condition. Major structural repairs following the 1993 bomb blast were successfully completed and signed-off by a Permit to Occupy or Use issued by the Port Authority Office of the Chief Engineer on October 10, 1997. The repairs appear to have been properly engineered and executed. Following the bombing incident, stringent security measures were implemented at the vehicular entrances to the Plaza and subgrade facilities.

In the buildings we observed only minor cracking in some slabs, partitions or in stairwells of the buildings. Some minor slab cracks have been noted which should be monitored by the PA's structural consultant. The slabs at the truck dock and delivery area on level B-1 have deteriorated due to ice-melting salts that enter the building on vehicles during the winter. A slab replacement program is ongoing and should be continued until all of the damaged slabs are replaced. The monitoring of the visco-elastic movement dampers in the two Towers is an essential program that has been strongly recommended for continuation by the PA's outside structural consultant. Building movement is monitored by analysis of measurements taken and recorded by devices located in the 108th floor of 1 WTC. Analysis of these records is done by the Port Authority's independent engineer (LERA) and should continue in the future. In addition, physical sampling and analysis of the condition of the visco-elastic dampers is reportedly continuing on a 5-year cycle, with the next sampling to be done in 2001. The slurry wall that surrounds and contains the subgrade levels of the complex has some seepage that is contained by curbing and leaders, and is discharged by sump pumps in the lowest levels.

The slurry wall and the adjacent floor slabs that brace the wall are inspected on an ongoing basis to ensure that unsafe conditions do not develop. Structural Integrity Inspection (SII) Report I-38, dated April 3, 1998, provided in the Data Room, found the conditions to be acceptable. These periodic inspections should continue.

The rating of the structural fireproofing in the Towers and subgrade has been judged to be an adequate 1-hour rating considering the fact that all Tower floors are now sprinklered. An ongoing program of re-fireproofing the structural steel to the full thickness for 2-hour rating is in place. This work is done on a lease rollover basis whenever there is a full floor of space being built out for new occupancy. To date approximately 30 floors have been completed in the two towers. The PA will require this program to continue. The presence of asbestos containing

structural fireproofing is documented and abatement in tenant spaces is being done in conjunction with lease rollovers. Abatement of asbestos containing fireproofing material in elevator shafts is ongoing. Air monitoring and physical inspections are carried out as part of the regular asbestos O&M Plan. Patching of non-asbestos fireproofing is handled through a program of in-house inspection and repair.

Exteriors

Building exteriors are generally functioning adequately. A regular program of inspection is carried on by ABM, the maintenance contractor, and is monitored by a private consultant engaged by the Port Authority. Exterior caulking and repairs are done as required based on the findings of the 2 inspecting agencies. Ongoing repair to the finishes on the 4 and 5 WTC buildings should be expected and, within the 10-year term, it would be advisable to consider a wet-seal and repainting program for those 2 buildings. There have been proposals for refinishing the 2 Tower buildings which, to date have not yet been implemented. This issue will also need to be addressed within the 10-year term. Other exterior conditions, which require ongoing monitoring, and repair as necessary are the exterior marble panels on some of the lower areas of the retail base of the complex and the exterior plaster soffits on the 4 and 5 WTC buildings.

There has been a problem with ice forming on and falling from the Towers during early and late winter months. The problem is most severe when the temperature at the upper Tower levels (which is several degrees colder than at the Plaza Level) falls below freezing. During high humidity days, ice balls can form and dislodge from the wall and roof surfaces. Damage to nearby buildings and injury to pedestrians has occurred. The Port Authority is well aware of this condition and the PA Police Department takes appropriate action to restrict access to sidewalks and the Plaza when the condition occurs. When surrounding streets are involved, the NYC Police are also advised and involved accordingly. There does not appear to be an architectural solution to this problem as it is caused by an unusual atmospheric condition. In addition, there are incidences of noise generated either by the movement of the Tower corner panels or by the movement of underlying back up deck material during high wind conditions when the Tower movement is significant. There are no signs that this movement has caused any damage to the panels or attachments at this time.

Roofs

The roofs of 1 and 2 WTC are the original membrane systems protected by rigid insulation and a 5" thick concrete overlay. These roofs appear to be serving adequately, with only local repairs to the spalled concrete wearing course required over the next 5 years. The roof of 4 WTC is nearing the end of its anticipated service life and replacement should be anticipated. The roof of 5 WTC was replaced in 1991 and may still be under warranty. Requirements for warranty transfer should be investigated. The bituminous membrane under the Plaza deck, which acts as the roof of the retail area, was examined extensively as part of the work done when the Plaza was refinished last year. There are still some chronic leaks at specific locations; such as at the Tower expansion joints and the expansion joint along the Church Street side, but these leaks are corrected as they occur as part of maintenance.

Interiors

Interior conditions are generally good. Full floor office tenants are reportedly responsible for all finishes on their floors. Finishes on the multi-tenant floors will continue to need periodic replacement. Rest room finishes are now about 25 years old and thought should be given to a phased program of modernization on multi-tenant floors. The 20" x 20" ceiling tiles used in some areas are no longer manufactured and the replacement of these ceilings with standard grid ceilings, rather than having custom tiles manufactured, is recommended when replacement or modernization is necessary. Remediation of deficient tenant separation walls and public corridor walls on office floors is being accomplished as new tenant spaces are built-out. While some of these walls do not extend to the underside of the slab, the condition is not deemed to be an immediate problem in this fully sprinklered facility. Vestibule entries for mechanical rooms entered from fire stairs will need to be added in phases.

The Mall spaces are in good condition with various recent build-outs by national retailers. Phased upgrades of Mall common area finishes have also begun, and consideration should be given to continuing the upgrading throughout the rest of the Mall. Monitoring of the Mall ceiling suspension system is done on a regular basis and should continue to be part of the normal maintenance program. Two additional means of egress have been added to the Mall circulation pattern, following a 1992 study by the World Trade and Engineering Departments. Installation of the third additional Mall egress is pending.

Vertical Transportation

The 238 WTC elevators are being maintained under a full-service contract with Ace Elevator. The survey by BOCA Group International, Inc. initially included visual observations of a pre-selected random sampling of 21 elevator and escalator devices at the buildings, and the review of available documentation pertaining to elevator maintenance and modernization programs. The sample elevators selected for observation were chosen to provide a representative specimen from each building and zone and included modernized, partially modernized, and original elevators. Following the initial sampling, BOCA further reviewed and observed additional devices based on callback data provided by the Vertical Transportation Department and on reports prepared by the Port Authority's independent elevator consultant. An evaluation of the maintenance indicates that "maintenance practices range from acceptable to marginally acceptable, with definite room for improvement in the area of housekeeping." In addition the elevator survey reported significant deficiencies that should be addressed under the terms of the full service contract. In general, it was reported that the service contractor is not proactive in addressing problems and that close oversight by the PA Vertical Transportation Department is necessary to maintain acceptable service and maintenance levels.

The modernization of all passenger cabs with new interior finishes, overlay controllers, ADA features, and firemen's recall has recently been completed. The second phase of the modernization program, including switching over from motor generator sets to SCRs, retrofitting door operators, and installing new door-reopening devices, is ongoing (126 completed, 8 in progress) and should be continued to completion (104 not yet modernized). The modernization is resulting in better service and a higher quality ride. When completed, the elevator system can be considered to be equal to those of new Class "A" office buildings. The high-rise shuttle cars in 1 and 2 WTC and the 6 and 7 cars in each Tower are equipped with "elevator followers" which are designed to eliminate rope impact on shaft elements. The venting of elevator shafts in the two towers is through the elevator machine rooms, due to the configuration of elevators over elevators in the central cores. This has been accepted as the only viable solution by the Port Authority as the Code enforcing agent. A test sample of the "Captivate" system, a high resolution monitor carrying news, weather, and internet information within elevator cabs was recently completed. The system is now to be installed throughout the complex.

All escalators have been modernized with start/stop switches, comb plate switches, demarcation lights, caution signs, controlled descent devices, and remote monitoring systems. Carl White devices have thus far been installed on 2 escalator units.

HVAC

The mechanical systems were adequately designed and constructed using brand-name equipment, which provides adequate cooling for the complex. The freeze protection system, recently installed in the 108th floor mechanical equipment room (MER) of 1 WTC, is budgeted to be installed in all the buildings' MERs so that air conditioning will be available throughout the year (especially during normally cooler months when the outdoor temperatures rise higher than normal).

The 2 Towers exhibit a stack effect where there is either high negative or positive pressures that effect the opening and closing of doors and emit loud noise through the elevator shafts. This is particularly noticeable when there are large differences between indoor and outdoor temperatures, especially in the winter and on very humid days. The stack effect will also cause smoke from any subgrade fires to be pulled upward into the building. For this reason, a smoke evacuation system for the PATH station has been designed and budgeted (see Life Safety in this section).

In 1985, Lucius Pitkin Consulting Engineers, an independent consulting firm, was hired to examine the welds on the high-pressure steam pipe risers. The Pitkin Report stated that many welds exhibited flaws, such as insufficient penetration and cracks in circumferential welds. The report recommended that all welds be examined and that any weld lacking 50% or less penetration be removed and repaired. To date this work has not been done, nor have any welds exhibited leaks. Based on the piping system's satisfactory history, we recommend that the program of monitoring the pipe welds be continued and that the leaks be repaired as they occur. We do not find any evidence that warrants any program of system-wide corrective action.

Although in operation, the majority of equipment is past its published service life, and replacement of the equipment should be anticipated. A major capital project to update the air handling systems has effectively increased the service life and reliability of the air handling equipment. Equipment and component replacement is now performed as part of the ABM service contract.

Since its original construction, the central refrigeration plant has been expanded to include an additional 10,000 tons of capacity and improved performance. Full winter operation of the chilled water systems is now possible and redundant river water piping systems allow for improved service and maintenance programs. Both refrigeration plants operate on R-22 refrigerant. The use of Hudson River water for the cooling plant is in compliance with environmental regulations.

Merritt & Harris, Inc. reviewed the findings of a report written by Jaros, Baum, & Bolles (JB&B), Consulting Engineers, New York, New York, dated October 31, 1996. The report was written for the Port Authority and JP Morgan & Co. Inc. It presented an evaluation of the physical condition of the existing Base Building HVAC, electrical, plumbing, and fire protection systems at the WTC. The WTC 1, 2, 4, and 5; the Mall; and the Subgrade were covered in the report. The majority of the JB&B report's findings addressed issues that we consider to fall within the category of normal maintenance. The Port Authority has addressed, or is in the process of addressing and correcting, the issues noted in the JB&B report. Our observations and reviews of documents have confirmed that the issues are being addressed.

Plumbing

The plumbing systems appear to be functioning satisfactorily. Although operational, the majority of plumbing equipment is past its published service life, and replacement of the equipment should be anticipated. Equipment component maintenance and repair is performed as part of the ABM service contract.

Water hammer arrestors, on a 2" water line in a wall on the 55th floor of Tower 1, recently failed flooding the 55th - 44th floors. Samples of the arrestors were sent out for independent evaluation. It was determined that the bellows in the arrestors failed due to repeated expansions and contractions over a 27-year period. Therefore, it is recommended that a program be undertaken to replace all water hammer arrestors in all buildings, before more failures and flooding occur.

Electrical

The electrical systems appear to be functioning satisfactorily, and adequate electrical capacity is provided for all of the buildings. Major upgrades have taken place including feeder and bus duct replacements. The main electric substations are not in compliance with NYC Code and there is no variance in place. The primary issue is the lack of ground fault protection provision before the switchboard. It is understood that the Port Authority approved this configuration, and since the Port Authority is expected to remain the Code interpreter for this installation, new requirements for compliance will not occur in the future. Some of the electrical substations have been modernized as part of a project-wide infrastructure program. In some of the smaller closets, there are clearance issues where new equipment has been installed. These installations are reportedly grandfathered until any new equipment is added and have been accepted by the Port Authority in its role as Code interpretation official. A new standby power plant, located on the roof of 5 WTC and distribution network (beyond that for emergency power), is available for tenant use. It is understood that an operating certification is not required for this installation since it is not intended for use as a co-generation facility.

Life Safety

The life safety systems are appropriate for this type of facility, and have been upgraded during the life of the complex. Currently a new fire alarm system is being installed throughout the facility, and this installation is addressing open issues including return air smoke detection and annunciation, elevator lobby smoke detector activation, public address loudspeakers, and standpipe telephone jacks. The Fire Command stations in each building have been completed and approved. The majority of spaces are sprinklered, except for main lobbies, electrical and mechanical spaces, and some toilet rooms. The sprinklering plan is consistent with the requirements of the New York City Building Code. A survey is required to determine which floors may have inadequate fire hose reach, and to establish a plan to make these floors become code-comforming.

Technically, the stairwells of the Tower buildings should be vented. Because of the height of the stairwells, however the installation of venting fans would not be practical and would, most likely, pull smoke into the stairways from the corridors, a condition that is not favorable. The Port Authority is aware of the lack of venting in the stairwells and, as the code enforcement agency, has accepted that the addition of venting would cause an unsafe emergency exiting situation.

Because of the stack effect, fumes and smoke from fires that may occur in the PATH station can migrate into the Mall area and eventually into the buildings. A plan to install smoke barrier drops at the PATH entrance ceiling and ducted smoke evacuation from the PATH station through the subgrade space have been approved and budgeted. This plan appears to be a sound one. We are informed that this work will begin shortly.

An egress study has been made which recommended that 3 additional means of egress be constructed in the Mall. Two exits were added and a third, exiting from the vicinity of the present Godiva Chocolatier shop, is planned and budgeted.

Energy Conservation

The buildings have a mix of clear single-pane glazing or tinted single-pane glazing. There is no energy management system, although the central plant control system can be used to check trends and manually optimize the equipment operation. It is of note that electrical power is provided by Consolidated Edison, but purchased directly from the New York Power Authority at a relatively low cost.

Maintenance

Electrical, HVAC and general maintenance is performed under the terms of a consolidated performance-based service contract by ABM Engineering, with oversight by the Port Authority World Trade Department's Building Services Management Division. In general, maintenance of the systems appears to be adequate. Housekeeping (cleaning) deficiencies were noted in stairwells, electrical closets, and service areas. Ongoing repairs and replacement of components were observed to be in progress in various areas. It should be noted that the ABM Engineering contract calls for both the maintenance and repair of equipment. If a new contract is entered into with a service company for maintenance only, the replacement of equipment must be accounted for separately.

ADA Accessibility

The office building entrances, travel routes, and elevators are ADA compliant. ADA compliance on most full tenant floors is reportedly the responsibility of the tenants under terms of the leases (Merritt & Harris, Inc. did not review the leases), which would be a common practice. ADA compliance for toilet rooms on multi-tenant floors is a building owner's responsibility. Upgrades to toilet rooms, signage, and door hardware for building common spaces should be made on multiple-tenant floors.

The Mall has ADA-accessible entrances on grade in numerous clearly marked locations. All ADA entrances have power-assist doors. Although the 2 Mall levels are individually accessible, interior interconnection between the Concourse and the Plaza Levels is available only by ramp and elevator in the 5 WTC building, the office building elevators in 4 WTC, and a private tenant elevator in the Border's Store. We recommend that the redevelopment of the vacant retail space in the southeast section (4 WTC area) include consideration for a public elevator in the Mall common area to streamline ADA access between levels. Public rest rooms in the Mall are accessible as defined by the ADA.

Violation Status

As stated in the Offering Memorandum, "The Port Authority is a municipal corporate instrumentality and political subdivision of the States of New York and New Jersey which provides transportation, terminal, and other facilities of commerce within the Port District. As such, in connection with the Transaction, the PA will continue to maintain exclusive jurisdiction with respect to certain administrative and governmental matters involving the Complex, including compliance with building, environmental, fire and health codes." The New York City Department of Buildings has indicated that they do not maintain any records of violations for this property. A request for a Property Profile Overview for this block and lot number yields no records. The Fire Department provides normal fire fighting and a life safety service to the facility. A Memorandum of Understanding exists between the Port Authority and the Fire Department in which the Fire Department performs regular inspections and directly notifies the Port Authority Fire and Life Safety group of deficiencies to be corrected. Under a protocol with the New York City Fire Department, Port Authority Police personnel investigate certain fire alarms at the World Trade Center rather than transmitting such alarms to the New York City Fire Department.

Environmental Site Assessment

During construction, essentially all soil down to 75' was removed, eliminating any potential pollution from previous uses of the site. R.W. Crandlemere & Associates identified other locations of recognized environmental conditions in the search radius, but concludes that none of these sites or the current use of the WTC, are likely to impact the environmental integrity of the subject site.

The use of Hudson River water for the cooling plant is in compliance with regulations. The current NYDEC State Pollutant Discharge Elimination System (SPDES) permit extends to May 1, 2004. Monitoring reports and SPDES inspections performed in 1999 and 2000 state, "no reported permit limit exceedences."

The 1999 Denny & Associates report concerning the broadcasting and transmission devices mounted on the roof of WTC1 were reviewed. Operational guidelines are currently in place to provide protection to trained workers and escorted visitors. Based on the Denny & Associates report, R.W. Crandlemere & Associates recommends further additional investigation concerning radio frequency exposure levels for visitors to the observation deck on 2 WTC.

The R.W. Crandlemere & Associates *Environmental Site Assessment* is included in its entirety in this report.

Asbestos

Asbestos-containing materials (ACM) were used as sprayed-on fireproofing and pipe insulation during the original construction. Vinyl-asbestos tile is present throughout the complex. The Port Authority has identified the areas having ACM, which are primarily tenant spaces, mechanical rooms, subgrade areas, and elevator shafts. A large portion of the ACM has been removed and the abatement process is continuing as tenant leases rollover and the spaces are retrofitted. Some abatement projects are carried in the capital budgets for 2001-2005 and other VAT and spray-on abatement work is treated as an operating cost. An Operations and Maintenance Plan has been produced and specific staff personnel have been trained and certified as ACM handlers to deal with incidental disturbance of the material. Much of the ACM in the pipe insulation in the subgrade areas has been removed. Tenants occupying floors that may still contain asbestos material have been formally notified.

There is a reported litigation in process for cost recovery related to ACM abatement. This litigation was not reviewed as part of this report and questions pertaining to the subject should be addressed to the appropriate legal entity.

R.W. Crandlemere & Associates reports addressing the presence of ACM are provided in each individual building section of this report.

Specific Recommendations

Specific recommendations, items of concern, and building deficiencies are noted in **"E. Recommendations"** section of the individual property component reports. Priorities are divided into **Immediate (0-1 Year)**, **Future (1-5 Years)** and **Future (6-10 Years)** categories.

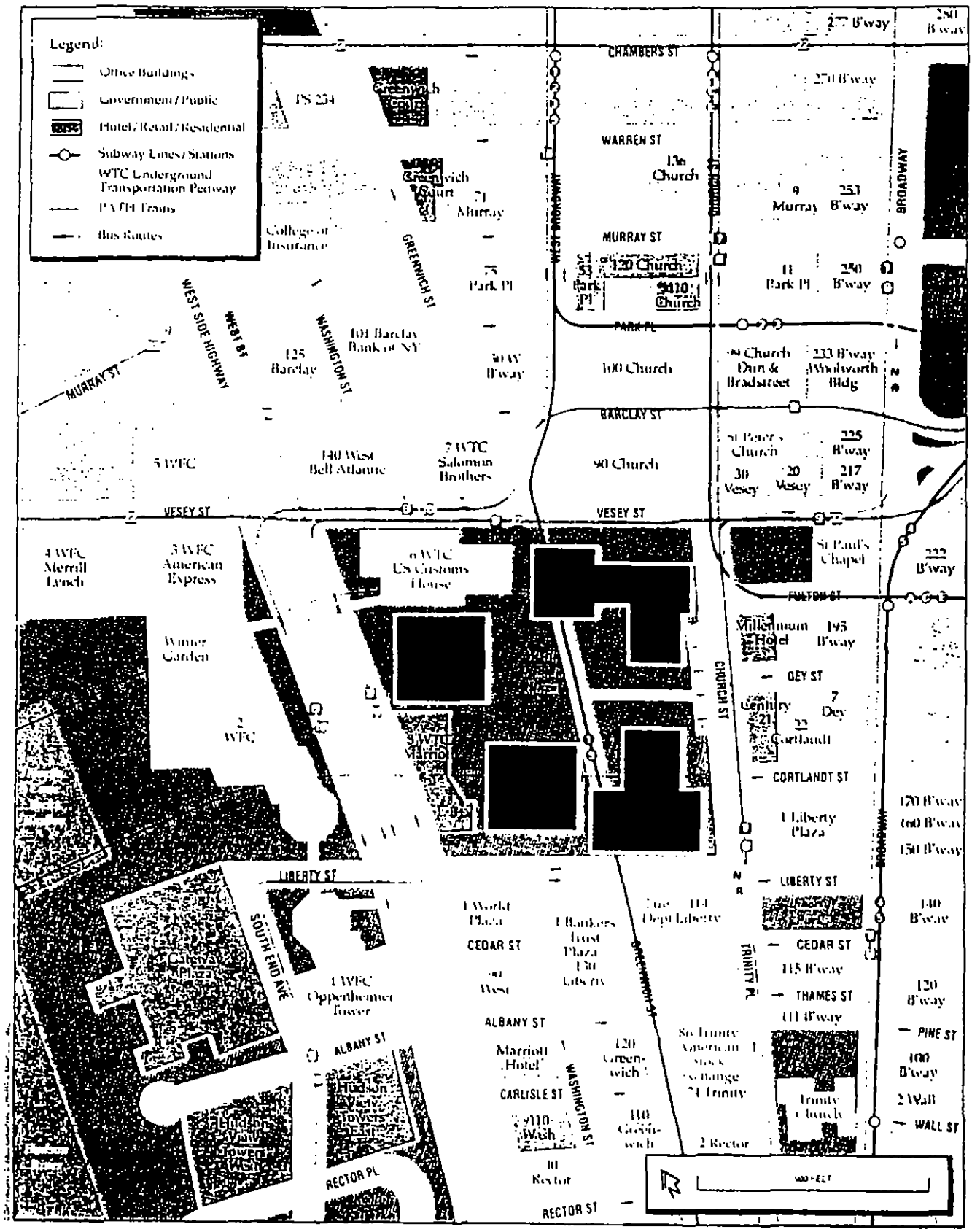
EXECUTIVE SUMMARY ATTACHMENTS

1. Neighborhood Map (Reproduced with permission from J.P. Morgan Property Book)
2. Résumés of participating Merritt & Harris, Inc. staff personnel
3. Due Diligence Check List of Documents as of October 31, 2000
4. WTC - Proposed 2001 Capital Plan
5. WTC - Proposed 2002-2005 Capital Plan
6. R.W. Crandlemere & Associates Environmental Site Assessment Phase I Report (separate binder)
7. BOCA Group International, Inc. - Overall Observation

ATTACHMENT 1

Neighborhood Map
(Reproduced with permission from J.P. Morgan Property Book)

World Trade Center Neighborhood Map



ATTACHMENT 2

Resumes of participating Merritt & Harris, Inc. staff personnel

THOMAS C. RICHARD, AIA

President & Chief Executive Officer

ACCREDITATION	Registered Architect in the State of New Jersey
PROFESSIONAL AFFILIATIONS	New Jersey Society of Architects Architects League of Northern New Jersey American Institute of Architects (AIA) American Society for Testing and Materials (ASTM) Mortgage Bankers Association - New York Urban Land Institute
EDUCATION	Bachelor of Arts, Fordham University School of Architecture, Pratt Institute
MERRITT & HARRIS, INC. *New York, NY*	Mr. Richard joined the consulting firm in 1981 as a Project Manager and was appointed Vice President in 1984. In 1987 he was named Senior Vice President & Principal heading the Due Diligence Division, which provides total building evaluation services to the real estate financing and investment community. In 1996, Mr. Richard became President & CEO of Merritt & Harris, Inc.
HARSEN & JOHN PARTNERSHIP ARCHITECTS *Tenafly, NJ*	Employed as a Senior Project Supervisor, Mr. Richard worked for the architectural firm from 1969 through 1976. His responsibilities included design and construction supervision of multi-million dollar educational, municipal, and multi-family housing projects. Mr. Richard rejoined the partnership in 1978 as the Director of Operations, with supervisory control of design, document production, construction, and administrative functions of that forty person office, and organized a subsidiary architectural interiors company.
G&R SERVICES *Bogota, NJ*	From 1976 to 1978 Mr. Richard was a partner of a design/build construction company. His duties included administration, construction supervision, design, and estimating. He served as on-site Educational Facilities Design Consultant to the Federal Republic of Nigeria for the design of the National Educational Technology Center in Kaduna, Nigeria.

ROBERT G. WEILAND, R.A.

Principal - Due Diligence

ACCREDITATION	Registered Architect in the State of New York
EDUCATION	Bachelor of Architecture, Pennsylvania State University Graduate Study - Architectural Technology, Columbia University
MERRITT & HARRIS, INC. *New York, NY*	Mr. Weiland joined the consulting firm in 1984 as a Project Manager and evaluated various projects throughout the United States. His responsibilities include review of construction drawings and specifications, and field observation of new and existing construction. Appointed Vice President in 1988, he assumed the responsibilities of coordinating nationwide, multi-site portfolio observations, and developing formats for the presentation of real estate tax appeal projects for municipal government clients. In 1996, Mr. Weiland was appointed a Principal of Merritt & Harris, Inc.
Major Projects	Chrysler Building - New York, NY Macy's Portfolio - Various Nationwide Locations IBM Tower - Atlanta, GA Rockefeller Center - New York, NY Alamoana Shopping Center - Honolulu, HI
IFFLAND, KAVANAGH, WATERBURY, PC *New York, NY*	An Associate of the firm, Mr. Weiland was responsible for industrial, commercial, and television broadcast projects, from initial client contact through program development. His duties also included the production of construction drawings and specifications, and supervision of construction. He was an employee of the firm from 1978 to 1984.
MARINE MIDLAND BANK *New York, NY*	Mr. Weiland worked for the bank as an Architectural Designer in the facilities management department from 1974 to 1978. His job responsibilities entailed client contact for program development and preliminary design, as well as construction document preparation and field supervision for the construction of corporate office facilities and branch banks.
URS/MADIGAN - PRAEGER *New York, NY*	As a Project Architect in 1973, Mr. Weiland prepared construction documents and made field inspections for renovation projects including, municipal garages, stadiums, and waterfront facilities.

JACK M. KAGAN

Principal - Mechanical/Electrical Engineer

ACCREDITATION	Certified, National Board of Boiler and Pressure Vessel Inspectors Certificate of Competency, State of New York Department of Labor, Bureau of Boilers
PROFESSIONAL AFFILIATION	American Society of Mechanical Engineers
EDUCATION	Associates Degree in Applied Science - Mechanical Technology, New York City Community College Bachelor of Mechanical Engineering Degree, Pratt Institute
MERRITT & HARRIS, INC. *New York, NY*	Mr. Kagan joined the consulting firm in 1984 as a Mechanical Maintenance Equipment Specialist. His responsibilities included design review of mechanical, plumbing, electrical plans and specifications, and field evaluation of new and existing construction. In 1988 Mr. Kagan was named Assistant Vice President-Electro/Mechanical Engineer. Mr. Kagan was appointed a Principal of Merritt & Harris, Inc. in 1996.
Major Projects	Ice Palace - Tampa, FL Chrysler / Kent Buildings - New York, NY Las Colinas Office Buildings - Dallas, TX The Waikaloa Resort - Honolulu, HI Greenway Office Towers - Houston, TX
ROYAL INSURANCE CO. *New York, NY*	As a member of the Boiler and Machinery Department from 1981 to 1984, Mr. Kagan was responsible for the technical support of sixty-five field offices and home office departments, for all phases of boiler and machinery equipment insurance.
HEMPSTEAD RESOURCES RECOVERY *Garden City, NY*	Mr. Kagan worked as a process supervisor from 1978 to 1980 and was responsible for the processing of two thousand tons of municipal garbage per day for metals recovery and fuel production for a 40 MW electric generating station.
E.I. DUPONT *Newark, NJ*	Serving as a mechanical supervisor in the Engineering Department, Mr. Kagan was responsible for project engineering, minor construction, and powerhouse and waste treatment operations. He also served as Production Supervisor in the Organic Color Pigments Finishing Department. Mr. Kagan worked at E.I. DuPont from 1974 to 1978.

PETER J. BRADY, P.E.

Project Manager -Due Diligence

ACCREDITATION	Professional Engineer in New York State
EDUCATION	Bachelor of Civil Engineering, City College, City University of NY Master of Civil Engineering, City College, City University of NY
MERRITT & HARRIS, INC. *New York, NY*	Mr. Brady joined the consulting firm in 1994 as a Project Manager for the evaluation of various projects throughout the United States. His responsibilities include the review of construction drawings and specifications, and field observation of new and existing construction.
Major Projects	DisneyWorld Swan & Dolphin Hotels - Orlando, FL Hato Rey Tower - San Juan, Puerto Rico Ritz Carlton - Naples, FL West Port Plaza - St. Louis, MO Wolfchase Galleria - Memphis, TN
DEPARTMENT OF HOUSING PRESERVATION & DEVELOPMENT *New York, NY*	Mr. Brady was hired in 1960 as an Assistant Civil Engineer. His responsibilities included being a field engineer for all phases of hi-rise residential construction. Promoted to Civil Engineer in 1964, his new responsibilities included the review of hi-rise plans and specifications for code compliance, coordination, and completeness. As a Senior Civil Engineer, Mr. Brady supervised engineers on review and coordination of plans and specifications. In 1972 Mr. Brady was promoted to Chief of Engineering and Construction for the New York HPD's Middle Income Housing Program. During the 1980s he directed the HPD's conversion from new construction to substantial and moderate rehabilitation. He developed procedures and forms for recording and evaluating the condition of vacant/vandalized buildings. Mr. Brady also prepared construction standards for compliance with various loan program requirements, and developed parameter cost estimating procedures using personal computers and spreadsheet packages.

JOSEPH J. MARCIANO, P.E.

Mechanical/Electrical Engineer

ACCREDITATION	Licensed Professional Engineer in the State of New York
PROFESSIONAL AFFILIATION	Member, American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
EDUCATION	Bachelor of Science, Cornell University Construction Management Diploma - The Real Estate Institute at NYU
MERRITT & HARRIS, INC. *New York, NY*	Mr. Marciano joined the firm as a Mechanical Engineer in 1996. His job responsibilities include design review services for adequacy and completeness of mechanical and electrical systems for new construction and renovation work. Mr. Marciano's due diligence work includes detailed reviews of the HVAC, plumbing, electrical, life safety, and energy conservation systems of existing buildings.
Major Projects	Warner Theater Building - Washington, DC Blanchard Plaza - Seattle, WA Greenwich Office Park - Greenwich, CT Reston Town Center - Reston, VA West Port Plaza - St. Louis, MO
COMPREHENSIVE DEVELOPMENT CORPORATION *New Rochelle, NY*	As a Construction Consultant from 1991 through 1996, Mr. Marciano provided estimating, scheduling, and claim servicing, as a well as site evaluations, and plan review and coordination. His various responsibilities, included coordinating the mechanical, electrical, and plumbing work at two primary schools for the New York City School Construction Authority. Mr. Marciano also coordinated the contractors in the field, maintained the project records and interfaced with the designers and the client.
NASCO ASSOCIATES *New York, NY*	Mr. Marciano served as a Project Manager and Senior Estimator for this construction management and consulting firm. He specialized in field coordinating and project cost estimating during all stages of design, from conceptual to final, including change order evaluation. Other duties included scheduling, inspecting, handling contractor claims and performing value engineering studies. Mr. Marciano also served as an engineering audit officer on the Stuyvesant High School project in Battery Park City. Mr. Marciano worked for Nasco Associates from 1987 to 1991.

ATTACHMENT 3

Due Diligence Check List of Documents

WORLD TRADE CENTER
DATA CENTER
DUE DILIGENCE CHECKLIST
(As of October 31, 2000)

ITEM		
A	GENERAL PROPERTY INFORMATION	
	1	Offering Memorandum (x2)
	2	Property Book (x2)
B	LEASING INFORMATION	
	1	Argus Rent Roll as of 10/1/00
	2	Port Authority's Rent Roll
	3	WTC Fixed Billing System as of 11/1/00
	4	Leasing Activity Reports
		a. June-Current 2000
	4	Retail Sales Reports
		a. 1998 & 1999
		b Year to Date 2000
		c Total Sales by Store - First Six Months (2000 vs. 1999)
	5	Port Authority ("PA") Comptroller's Suffix Descriptions for WTC Fixed Rent Roll
	6	Copies of Retail, Office and Subgrade Leases and Lease Abstracts
		a. Office Tenants
		b Retail Tenants
		c Subgrade Tenants
		d Telecommunication/Broadcasting Tenants
	7	Leases Under Negotiation and Expected Terms for 2000

ITEM		
8	PA Comptroller's List of WTC Percentage Agreement Tenants	
9	Telecommunication/Broadcasting Agreements	
	a.	Summary of deals
10	Copies of Existing Ground Leases	
	a.	Marriott Hotel
		i Privilege Permit dated as of 1/1/98 to HMH WTC, Inc.
	b	Customs House
11	Remeasurement Study	
C	FINANCIAL INFORMATION	
1	WTC Allocation Methodology Summary of Financial Statements included in the Offering Memorandum	
2	2000 PA Operating Forecast	
3	Historical Operating Statements [1997-1999]	
4	Payroll	
5	Real Estate Taxes	
	a.	Current Assessed Valuation for Block 58, Lot 1
	b	Agreement between the PA and the City of New York, dated as of 1967 regarding Payments in Lieu of Taxes ("PILOT")
	c	1999/00 letter to New York City ("NYC") Explaining PILOT Calculation
6	Agreement between the PA and The Alliance For Downtown New York, Inc., with respect to BID Payments	
	a.	February 9, 1995 Agreement
	b	December 24, 1998 Amendment
7	Capital Expenditures	
	a.	Updated Capital Plan
8	Miscellaneous	

ITEM		
	a.	10/1/00 Rental Receivables Reports
D	ENVIRONMENTAL INFORMATION	
	1	Summary of Environmental and Asbestos Due Diligence
	2	Asbestos Records, including a disclosure memo, identifying known locations of asbestos-containing materials; abatement project files; quantities removed; and estimates of remaining quantities
	3	Known Location of Asbestos
	4	NYS DEC State Pollutant Discharge Elimination System (SPDES) Discharge Permit, dated 4/12/99
	5	Annual Regulatory Permits/Licenses, including Petroleum and Chemical Bulk Storage
		a NYS DEC Petroleum Bulk Storage Registration Certificate, issued 8/4/98
	6	Hazardous Materials Response Plans, inventories and certificates
	7	Hazardous Waste Manangement records and inspections
	8	Annual U.S. Environmental Protection Agency SARA Title III Community-Right-To-Know Inspection Reports-Tier II
	9	Annual New York State Department of Environmental Conservation Annual Environmental Audit and Toxic Release Inventory
	10	Evaluation of Radio Frequency Environment at the WTC-North Tower (Richard Tell 9/97)
	11	RE-Evaluation of Radio Frequency Environment at the WTC-North Tower (Supplemented 9/5/99, revised 3/21/00)
	12	Denny & Associates: Electromagnetic field strength survey - South Tower (1/99)
	13	Investigation of RF Safety Cosiderations on the WTC Antenna Mast (Richard Tell 5/12/00)
	14	Condenser, Hot & Chilled Water Report as of 9/30/00
	15	United States of America Federal Communications Commission Antenna Structure Registration, issued 3/23/98

ITEM	
E	OPERATING AND MAINTENANCE MANUALS
1	River Water Pump Station - Vol. 1
2	Remote Lighting Control System - Vol. 2
3	Chiller Plant Addition B6 Refrigeration Plant - Black Binder
4	Mechanical System: Central Refrigeration Plant - Vol. 3
5	Mechanical System: Central Refrigeration Plant (2500 ton chillers) - Vol. 3A
6	Electrical System: Central Refrigeration Plant - Vol. 4
7	Electrical System: Central Refrigeration Plant (2500 ton chillers) - Vol. 4A
8	High Voltage Distribution System - Vol. 5
9	Low Voltage Distribution System, Towers A & B - Vol. 6
10	Emergency Power Distribution System - Vol. 8
11	Plaza Sculpture Fountain System - Vol. 9
12	Low Voltage Distribution System, NEPB & SEPB - Vol. 10
13	Low Voltage Distribution System, Subgrade Levels - Vol. 11
14	Smoke Detection System-Observation Deck, Tower B - Vol. 12
15	Domestic Water System: Tower A & B - Vol. 14
16	HVAC System Tower A & B - Vol. 15
17	Elevator System - Vol. 20
18	Antenna Heating System - Tower A - Vol. 21
19	Fire Protection System - Vol. 23
20	Sewage & Sump System Sublevels Tower A & B - Vol. 25
21	Window Washer & Exterior Platform Equipment Towers A & B - Vol. 31
22	Window Washing & Exterior Wall Maintenance Systems SEPB & NEPB - Vol. 32

ITEM			
	23		Computer Cooling Water System - Towers A & B - Vol. 33
	24		Computer Cooling Water System - NEPB & SEPB - Vol. 34
F	PERFORMANCE INDICATORS		
	1		Fourth Quarter '99, First & Second Quarter '00
G	CAPITAL EXPENDITURE CONTRACTS		
	1		Memorandum summarizing Elevator Modernization Programs
H	SERVICE CONTRACTS		
	1		Contract WTC-799.700: Amendment No.1 to Agreement to Perform Maintenance of Elevators, Dumbwaiters & Escalators: 1,2,4,& 5 WTC (3/18/99)
	2	a	Contract WTC-891.073: Furnish, Install and Configure Office Space Security System Software at the World Trade Center
		b	Contract WTC-799.610: Maintenance of Office Space Security System Software at the WTC (5/94)
	3		Contract WTC 845.071: Modernization of Elevators, Dumbwaiters and Escalators: 1 WTC (3/94)
	4		Contract WTC 838.071: Modernization of Elevators and Escalators- 4 & 5 WTC (9/93)
	5		Contract WTC 846.071: Modernization of Elevators and Escalators 2 WTC (3/94)
	6		WTC Agreement No. 990102: Provision of Construction Management Services on a "Call-In" Basis
	7		TDI Advertising Contract (The Mall)
	8		Contract WTC 799.60: Ironbound Flooring Installation
	9		Contract WTC 891.074: Purchase of Key & Lock Cylinder System (office space security system hardware)
	10		Contract WTC 799.47A: Maintenance Painting via Work Order 1, 2, 4 & 5 WTC
	11		Contract WTC 822.071: Emergency Power For Condenser Water System No. 1

ITEM	
12	Fire Alarm Maintenance Replacement Parts & Technical Services (Req. #52618)
13	Contract WTC 799.39: Maintenance of Centrifugal Refrigeration Machines with Supplemental Agreement and Extension
14	Contract WTC 799.710: Agreement to Perform Consolidated Electrical, Mechanical & General Maintenance Services
15	Contract WTC 799.688: Provide Maintenance of Six (6) Diesel Generators
16	Exercise of Option Period Agreement with Grand Central Neighborhood Social Services Corp. to Provide Labor for the Collection and Sorting of Recyclable Paper
17	Contract PSE - 727: Refinishing & Restoration Services of the Stainless Steel Surfaces – Concourse, Skylobby Levels of 1, 2, 4 & 5 WTC
18	Contract PSE - 801: Restoration of Stainless Steel & Other Metal Surfaces
19	Cleaning & Cleaning Related Services – Request for Proposals
20	Contract PSE - 864: Collection of Recyclable Waste Paper – Agreement with Manhattan Bowery Management Corp., NY
21	Contract PSE - 634: Trash Removal & Recycling Service at the WTC
22	Contract PSE - 821: Refuse Removal, Recycling & Disposal
23	Contract PSE - 821: Refuse Removal, Recycling & Disposal at WTC for 2 years
24	Contract PSE - 850: Removal of Construction Debris from the WTC
25	Contract WTC-463.00: Removal of Construction Rubbish, dated June 1995
	a Assignment and Assumption with Consent of Contract WTC-463.00: Removal of Construction Rubbish, dated October 1996
26	Contract WTC-697.00: Construction Labor Services
	a Amendment Number One to Contract WTC 697.00: Construction Labor Services
27	Contract WTC-457.03: Design Build Services for 1, 2 & 3 WTC

ITEM		
	28	Maintenance of Office Space Security System Software
	29	Contract WTC 799.56A: Agreement to Provide Fire Safety Director Service-1,2,4 & 5 WTC
	30	Design/Build Services for Tenants
	31	Contract WTC 799.690: Fire Alarm System Service Agreement for the World Trade Center Complex
	32	Contract WTC 115.300: Removal and Disposal of Vinyl Asbestos Floor Tiles and Other Asbestos-Containing Material Via Work Order (11/99)
	33	Contract WTC 881.072: Rehabilitation of B-1 Level (Truck Dock) Floor Slab (9/99)
I	STRUCTURAL INTEGRITY INSPECTION REPORTS by LESLIE E. ROBERTSON	
	1	Concourse, Subgrade, Marriott Back of House, 4 & 5 WTC Space Usage (11/20/98)
	2	Concourse, Subgrade, Marriott Back of House, 4 & 5 WTC Space Usage (12/24/97)
	3	River Water Pump Station (9/22/98)
	4	River Water Pump Station (4/28/95)
	5	Concourse Plaster Ceilings (9/18/98)
	6	Accessible Columns - 4 & 5 WTC (8/19/98)
	7	Elevator Pits & Machine Rooms - 1, 2, 4 & 5 WTC (10/30/99)
	8	Elevator Pits & Machine Rooms - 1, 2, 4 & 5 WTC (7/20/98)
	9	Elevator Pits & Machine Rooms - 1, 2, 4 & 5 WTC (12/18/97)
	10	Exterior Plaster Soffits - 4 & 5 WTC (7/20/00)
	11	Exterior Plaster Soffits - 4 & 5 WTC (7/15/98)
	12	Exterior Plaster Soffits - 4 & 5 WTC (8/31/96)
	13	Space Usage Survey - 1 & 2 WTC (6/15/98)
	14	Space Usage Survey - 1 & 2 WTC (7/31/97)

ITEM	
15	Space Usage Survey - 1 & 2 WTC (9/20/96)
16	Space Usage Survey - 1 & 2 WTC (9/20/96)
17	Slurry Walls & Adjacent Slabs - 1 & 2 WTC (6/98)
18	Slurry Walls & Adjacent Slabs - 1 & 2 WTC (5/28/97)
19	Slurry Walls & Adjacent Slabs - 1 & 2 WTC (7/16/96)
20	Accessible Columns - 1 & 2 WTC (5/30/98)
21	Accessible Columns - 1 & 2 WTC (5/23/97)
22	Accessible Columns - 1 & 2 WTC (5/1/96)
23	Floor framing - 4&5 WTC (7/24/98)
24	Plaza Level Box Columns (5/8/98)
25	Lobby Ceilings - 1 & 2 WTC (5/1/98)
26	Lobby Ceilings - 1 & 2 WTC (6/30/97)
27	Accessible Columns - 4 & 5 WTC (1/26/98)
28	Marble Panel Wall Inspection - 3, 4, 5 & Concourse Level at WTC (1/15/98)
29	Marble Panel Wall Inspection - 3, 4, 5 & Concourse Level at WTC (10/1/97)
30	Concourse Ceilings (5/23/00)
31	Concourse Ceilings (1/7/98)
32	Television Mast - 1 WTC (1/7/98)
33	Television Mast - 1 WTC (8/14/95)
34	Floor Frequency Measurements - 1 & 2 WTC (4/20/95)
35	Fire Stairs - 1 & 2 WTC (4/28/95)
36	Accessible Columns - 4 & 5 WTC (4/28/95)
37	Accessible Columns - 1 & 2 WTC (4/14/95)
38	Natural Frequency Measurements - 1 & 2 WTC (4/12/95)
39	Slurry Walls & Slabs at Slurry Walls (4/3/95)

ITEM	
40	Slabs, Partitions, Finishes and Floor Framing - 1 & 2 WTC (4/1/95)
41	Marble Panels - 1 & 2 WTC (3/13/95)
42	Marble Panels - 1 & 2 WTC (10/1/97)
43	Marble Panels - 1 & 2 WTC (8/30/99)
44	Bracing of 1 & 2 WTC below Elev. 294' – 0" (3/1/95)
45	Marble Panels - 3, 4, 5 & 6 WTC & Concourse Level (2/22/95)
46	Hat Truss between Floor 107 & the Roof (2/21/95)
47	Lobby Ceilings (1/17/95)
48	Crown Framing Deterioration - 1 & 2 WTC (11/16/94)
49	Exterior Plaster Soffits - 4, 5 & 6 WTC (11/21/97)
50	Exterior Plaster Soffits - 4, 5 & 6 WTC (5/28/92)
51	Concourse Plaster Ceilings - 4 & 5 WTC (5/1/91)
52	Damper Testing - 1&2 WTC (5/28/96)
53	Subgrade levels - WTC Facility Condition Survey Report (3/96)
54	Floor Slabs, Partitions, Column Finishes - 1&2 WTC (12/10/97)
55	Mechanical Equipment Rooms - 1&2 WTC (5/99)
56	Mechanical Equipment Rooms - 1&2 WTC (4/12/96)
57	B5 & B6 Passageway & Storage Area -WTC Subgrade (8/12/97)
58	Concrete Slabs, Partitions Column Finishes & Floor Framing over Tenant Spaces -1&2 WTC (6/28/96)
59	WTC Spray Fire Protection Tower Spandrels & Diagonals (10/1/96)
60	Tower Subgrade Levels WTC Facility Condition Survey Report (3/96)
61	WTC River Pump Station, U.S. Customs House Soffit, Plaza Level Slab & Concourse Level Ceiling Facility Condition Survey Reports (6/96)
62	Northeast & Southeast Plaza Buildings Facility Condition Survey Report(11/95)

ITEM		
	63	Northeast & Southeast Plaza Buildings Facility Condition Survey Report (9/94)
	64	Report on WTC Sidewalks (MEDD Architects 7/2 7/99)
	65	WTC Subgrade Parking Garage Slabs (1/00)
	66	1,2,4 & 5 WTC, Floor Framing (11/29/99)
	67	4 & 5 WTC, Mechanical Equipment Rooms (10/99)
	68	1 WTC, Pedestrian Access Bridges (9/28/99)
	69	4 & 5 WTC, Cantilever Trusses & Exterior Plaster Soffits (9/99)
	70	1 & 2 WTC, Floor Framing Inspection, Action Memo 1 (8/23/99) & Action Memo 2 (9/8/99)
	71	4 & 5 WTC, Floor Framing - Action Memo 1 (8/10/99)
	72	6 WTC Exterior Plaster Soffits (7/16/99)
	73	1 WTC, Natural Frequency Measurements (7/11/00)
	74	1 & 2 WTC, Crown Framing (6/30/99)
J	FACADES	
	1	Curtainwall - 1&2 WTC (Facades)
	2	Curtainwall and Roof Inspection - 1&2 WTC (10/29/99)
	3	Curtainwall - 4&5 WTC (Facades)
	4	Curtainwall and Roof Inspection - 4&5 WTC (4/28/95)
	5	Curtainwall and Roof Inspection - 4&5 WTC (10/9/98)
	6	1996 Structural Integrity Inspections - 1&2 WTC Facades
	7	1997 Structural Integrity Inspections - 1&2 WTC Facades
	8	1998 Structural Integrity Inspections - 1&2 WTC Facades
	9	Curtainwall reinspection 10% (10/29/99)
K	MECHANICAL REPORTS/INFORMATION	
	1	Maintenance Management Evaluation (6/99)
	2	Steam trap evaluation report (8/6/99)

ITEM		
3	Lucius Pitkin's Eddy Current Survey	
	a.	York Centrifugal Unit 2 (6/22/98)
	b	York Centrifugal Unit 3 (6/22/98)
	c	York Centrifugal Unit 5 (6/22/98)
	d	York Centrifugal Unit 6 (6/22/98)
	e	York Centrifugal Unit 1, 4 & 7-condensers and York Centrifugal Units 2, 3, 4-chillers (6/30/99)
	f	York Centrifugal Units 8, 9, 10, 11 & 12-condensers (7/21/99)
5	Summary memo of WTC River Water Lines (9/6/00)	
6	WTC 1,2,4,5 & Subgrade Air Handling Unit Rehabiliation (set of drawings) (5/13/98)	
L	VERTICAL TRANSPORTATION PROFILE & INSPECTION REPORTS	
1	Elevators	
	a.	1 WTC (Cars 1-99)
	b	2 WTC (Cars 1-99)
	c	4 WTC (Cars 1-12)
	d	5 WTC (Cars 1-9)
	e	Subgrade Cars-1WTC (P1, J1-J4)
	f	Subgrade Cars-2WTC (K1-K5)
	g	4WTC (FE1-FE4)
2	Escalators	
	a.	1 WTC: A1-A8
	b	2 WTC: B1 - B14
	c	S.E. Plaza (E14-E15)
	d	N.E. Plaza (E1-E13)
	e	PATH Escalators: P1-P11; P24; P27-P29
	f	Mall Escalators: E1, E2, E11-15, E17

ITEM		
3	Controller Manual s & Prints for Modernized Elevator Cars	
	a	ACE Elevator Co. CEC Futura Manual PA Contract #WTC 838.071, SEP Bldg. 4 Cars 1-6
	b	ACE Elevator Co. CEC Futura Manual Contract #WTC 838.071, SEP Bldg. 4 Cars 7-12
	c	ACE Elevator Co. CEC Futura Manual Contract #WTC 838.071, SEP Bldg. 5 Cars 1-6
	d	ACE Elevator Co. CEC Futura Manual & Diagram for Cars 12B, 13B PA Contract #WTC 846.071
	e	ACE Elevator Co. CEC Futura Manual Contract #WTC 845.071 SEP Bldg. 1 Cars 24A-29A
	f	ACE Elevator Co. CEC Futura Manual PA Contract #WTC 845.071, Bldg. 1 Cars 30A-35A
	g	ACE Elevator Co. Futura Manual & Magnetek DSD412 Manual Contract WTC 845.071, Bldg. 1 Cars 36A-41A
	h	ACE Elevator Co. CEC Futura Manual PA Contract #WTC 845.071, Bldg. 2 Cars 51A-56A
	i	ACE Elevator Co. Futura and Magnetek DSD412 Manual, Bldg. 1 Cars 87A-92A
	j	ACE Elevator Co. Controller Diagram for cars #93A-98A, PA Contract #WTC-845.071
	k	ACE Elevator Co. CEC Futura Manual PA Contract #WTC 845.071, 14 & 15A
	l	A.C.E. Elevator Co. Inc., Swift Futura, CEC Job No. 3331 cars 14A, 15A 1WTC Velocity/Fault Controller (1/29/9_)
	m	WTC Car 6B Setup Parameters
	n	A.C.E. Elevator Co. Inc., Swift Futura, CEC Job No. 2670 car 6B 2WTC Velocity/Fault Controller (4/18/95)
	o	Schematic Drawings, 2WTC-A.C.E. Elevator (Shuttle Cars) Job No. 3172, Cars 12B, 13B (3/20/97)
4	VDA Studies on WTC Elevator Fleet	
	a	Elevator door study (12/16/99)

ITEM		
	b	Examination of 1 WTC elevators 18-23 (5/11/00)
	c	Examination of 1 WTC elevators 1A-5A & 8A-11A (8/21/00)
	d	Examination of 2 WTC elevators 57B-62B & 87-92 (8/8/00)
	e	Examination of 2 WTC elevators 24B-29B (8/2/00)
	f	Examination of 2 WTC elevators 42B-47B (7/12/00)
	g	Examination of 2 WTC elevators 51B-56B (7/12/00)
	h	Examination of 2 WTC elevators 63B-68B (8/21/00)
	i	Examination of 2 WTC elevators 81B-86B (8/2/00)
	j	Examination of 2 WTC elevators 93B-98B (8/2/00)
	k	Examination of 1 WTC elevators 12A-17A (12/16/99)
	l	Examination of 1 WTC elevators 12A-17A (5/11/00)
	m	Examination of 2WTC elevators 1B-5B & 8B-11B (6/28/00)
	n	Examination of 2 WTC elevators 12B-17B & 18B-23B (8/21/00)
M	ELECTRICAL REPORTS	
1		Operations Services Department Inspection & Safety Division evaluation of the electrical maintenance program at WTC (2/99)
2		Burlington Engineering Co. Thermographic Scanning NE & SE Plaza buildings (3books) (8/8/96)
3		Burlington Engineering Co. Thermographic Scanning Subgrade levels including "A" Tower (6/17/96)
4		Burlington Engineering Co. Thermographic Scanning "B" Tower (2 books) (8/8/96)
5		Burlington Engineering Co. Thermographic Scanning "A" Tower (8/8/96)
6		Electrical Capacity Upgrades Summary
N	BLAST RELATED REPORTS/INFORMATION	

ITEM		
	1	WTC Explosion and Fire Environmental Investigation and Assesment Report
	2	Summary of Structural repairs as a result of February 26, 1993 Explosion (2 copies of 10 drawing sets)
	3	York Water Chiller System Post Blast Equipment Analysis
	4	Letter from Fire Department Attesting to Post-Bomb Adequacy of Life Safety Systems
	5	Description/Status of Fire System CADD
O	LIFE SAFETY CODE ANALYSIS (11/94)	
	1	ADA Transition Plan
	2	Contract WTC-799.56A Fire Safety Director Service 1,2,4 & 5 WTC
	3	Contract WTC-799.610 Maintenance of Office Space Security System Software at the WTC
	4	New Fire Alarm System description & status
P	TENANT CONSTRUCTION GUIDELINES	
	1	Tenant Construction Review Manual
	2	Fire Alarm Guidelines
	3	Electrical Communication
	4	HVAC, Plumbing & Fire Protection
	5	Architectural & Structural
	6	Pro Forma Applications
Q	MAPS & DRAWINGS	
	1	Tenant Location Plans / Space Book Plan
	2	Architectural Drawings of Property (10 CD-rom)
	3	Above-Grade Survey
	4	Detailed Retail Drawings
	5	Detailed Retail Drawings (4 CD-rom)
	6	CADD Drawings of the Subgrade

ITEM		
	7	Highly Illustrative Subgrade Drawings
	8	Subgrade Drawings (4 CD-rom)
	9	Parking Map
	10	Damage Map Pertaining to the Acquisition of Certain Real Property by the PA for WTC
	11	Base Building One-Line System Drawing
	12	Stack Plans
R	PUBLIC SPACE RENOVATION MASTER PLAN	
	1	Davis, Brody& Associates World Trade Center Master Plan
	2	Renovation Development Proposal (LaSalle Partners)
	3	Renovation Development Proposal (The O'Conner Group)
	4	Renovation Development Proposal (LCOR/The Hahn Company)
	a.	Volume 1: Development Team (2/1/95)
	b	Volume 2: Base Design Concept (2/1/95)
	c	Volume 3: Development, Management and Operating Proposal (2/1/95)
	d	Volume 4: Financial Proposal (2/1/95)
	e	Volume 5: Alternative Proposal (2/1/95)
	f	Volume 6: Design Concept, Retail Plan, and Events Presentation (2/16/95)
	g	Revised Proposal
	4	WTC Preliminary Study to Reduce Plaza Windiness
	5	WTC Plaza Stone Site Investigation
	6	Smoke Management Design Criteria
	7	Life Safety Systems & Emergency Evacuation
	8	Halcyon Report, Area Worker and Visitor Survey
S	AGREEMENTS	
	1	Agreements/Memorandums of Understanding

ITEM		
	a.	Union Agreements
	b	Power Authority of the State of New York Agreement
	c	Memorandum of Understanding ("MOU") with NYC Fire Department & Amendment
	d	MOU with NYC Building Department
	e	Agreement between the PA and NYC Pertaining to Certain Street Closings and a Change in the City's Waterfront Plan to Accommodate Certain Landfills being Created in Connection with the Development of WTC (6/67)
	f	Agreement between the PA and NYC Pertaining to Certain Street Closings in Connection with the Development fo WTC (1/68)
	g	Agreement between NYC, Fisher Liberty Co. and the PA Pertaining to the Liberty Street Pedestrian Bridge (8/76)
	h	Agreement between NYC and the PA Pertaining to the Liberty Street Underpass (5/12/80)
	i	Agreement between NYC and the PA Pertaining to the Dey Street Underpass (5/80)
	j	Settlement Agreement among NYC WTC7, and the PA Pertaining to the Vesey Street Deck (4/84)
T	LEGAL INFORMATION	
1	Pending Litigation Materials	
	a	Summons dated 11/10/99 with Dean Witter Reynolds Inc. against The Fund for Regional Development and Port Authority of New York and New Jersey (Index No. 605118/99)
	b	Answer dated 5/25/00 regarding Summons with Dean Witter Reynolds Inc. against The Fund for Regional Development and Port Authority of New York and New Jersey (Index No. 605118/99)
	c	Summons dated 1/7/00 with Guy Carpenter and Company Inc. against The Fund for Regional Development and Port Authority of New York and New Jersey (Index No. 600091/00), together with Complaint dated 12/29/99 attached thereto
2	Commonwealth Land Title Insurance Co. Documentation	

ITEM		
	a.	Title Commitment
	b	Copies of Recorded Easements and other Exceptions to Title
	c	Easement Agreement among PA, PATH, BPCD and BPCA (9/81) and Amendments thereto (2/82, 1/84)
	d	Letter from R. Gochfield, Dept. of City Planning, City of NY to H. Barr, PANYNJ re: Proposed Change in City Map for the WTC, with attached surveys
U	INTELLECTUAL PROPERTY INFORMATION	
	1	Schedule of Patents, Trademarks, Tradenames and Copyrights Held or Used and Documentation Relating to Related Claims
V	*MISCELLANEOUS*	
	1	Engineering Department Professional and Technical Service Firm Rosters for the Architectural, Electric, Environmental, Mechanical and Structural Disciplines
	2	World Trade Center Tenant Manual
	3	PA Comprehensive Annual Financial Report for the Year ended 12/31/99

ATTACHMENT 4

World Trade Center-Proposed 2001 Capital Plan

W TRADE CENTER - PROPOSED 2001 CAPITAL F · ROUGH BREAKDOWN BY BUILDING

($'s in thousands)

Proj Title	2001	Bldg 1	Bldg 2	Bldg 4	Bldg 5	Retail Mall	Subgrade	Central Sys
Electrical & HVAC Capacity Upgrade								
HVAC Distribution System Rehabilitation	1,000	400	400	100	100			
1 WTC 3d Zone Electrical & HVAC Capacity	1,000	1,000						
HVAC Control System/Smoke Mgmt	1,000					1,000		
HVAC Distribution Capacity Upgrade	2,500		2,500					
Freeze Protection Systems	1,000	1,000						
Plaza Bldg Electrical Capacity Upgrade	2,000			1,000	1,000			
New Fire Alarm System								
Fire Alarm System Phase 3 - PA Work	8,000	2,000	2,000	500	500		3,000	
Fire Alarm System Phase 3 - Tenant Reimb	250	100	100		50			
Other Building Systems Upgrades								
Operations Control Center	500							500
Tenant Standby Power	2,000							2000
Substation Ground Fault Protection	500							500
Antenna & Mast Rehabilitation Projects	500	500						
Building Mgmt/Energy Mgmt Systems	500							500
Common Area Improvement Programs								
Public Space Code Improvements	2,500					2,500		
Public Space Infrastructure Improvements	3,000					3,000		
Mall Circulation Improvements Phase 2	500					500		
Priority Customer Service Improvements	4,000	500	500			3,000		
Subgrade Rehabilitation Programs								
Subgrade Slab Rehabilitation Phase 1	10,000						10,000	
Subgrade Slab Rehabilitation Phase 2	500						500	
Subgrade Code Upgrade Projects	500						500	

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TRADE CENTER - PROPOSED 2001 CAPITAL P · ROUGH BREAKDOWN BY BUILDING

($'s in thousands)

Proj Title	2001	Bldg 1	Bldg 2	Bldg 4	Bldg 5	Retail Mall	Subgrade	Central Sys
Security Programs								
Permanent Security Project	500							500
Office Space Security System	500							500
Security Modernization Projects	5,000							5,000
Elevator and Escalator Modernization Programs								
Elevator Control Modernization - Tower 1	3,600	3,500						
Elevator Control Modernization - Tower 2	3,500		3,500					
Plaza Bldg Elevator Control Modernization	500			250	250			
Asbestos Abatement Shuttle Shafts	500	500						
Elevator Disconnect Switches	1,000	500	500					
Tenant Space Prep/Landlord Work Projects								
Lease Obligated Capital Work	2,000	750	750			500		
Multi-Tenant Floor Corridor & Restrm Rehab	3,000	1,000	1,000			1,000		
Building Infrastructure Rehabilitation Programs								
Priority Capital Major Work Projects	500							2,000
Capital Major Work Projects	5,000	1,000	1,000					
Other Asbestos Abatement	500		250	250				
ADA Projects	250					125	125	
GRAND TOTAL	68,000	12,750	12,500	2,100	1,900	11,625	14,125	11,500

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ATTACHMENT 5

World Trade Center-Proposed 2002-2005 Capital Plan

WORLD TRADE CENTER - PROPOSED 2002-2005 CAPITAL PLAN - ROUGH BREAKDOWN BY BUILDING

($'s in thousands)

Proj Title	2002	2003	2004	2005	2002-2005	Bldg 1	Bldg 2	Bldg 4	Bldg 5	Retail Mall	Subgrade	Central Sys
Electrical & HVAC Capacity Upgrade												
HVAC Control System/Smoke Mgmt	2,000	3,000	5,000	5,000	15,000	2,500	2,500					10,000
HVAC Distribution Capacity Upgrade	2,000	2,000	3,000	3,000	10,000	2,000	4,000					4,000
Freeze Protection Systems	1,000	1,000	1,000	1,000	4,000	1,000	3,000					
Plaza Bldg Electrical Capacity Upgrade	2,000	2,000	2,000	2,000	8,000			3,000	3,000			2,000
New Fire Alarm System												
Fire Alarm System Phase 3 - PA Work	8,000	4,000	0	0	12,000						10,000	2,000
Fire Alarm System Phase 3 - Tenant Reimb	250	0	0	0	250	100	100	50				
Other Building Systems Upgrades												
Operations Control Center	500	500	500	500	2,000							2,000
Tenant Standby Power	2,000	2,000	2,000	2,000	8,000							8,000
Antenna & Mast Rehabilitation Projects	500	500	500	500	2,000	2,000						
Building Mgmt/Energy Mgmt Systems	1,000	1,000	2,500	2,500	7,000							7,000
Common Area Improvement Programs												
Public Space Code Improvements	2,000	2,000	2,000	2,000	8,000					8,000		
Public Space Infrastructure Improvements	5,000	5,000	5,000	5,000	20,000					20,000		
Mall Circulation Improvements Phase 2	2,000	5,000	6,000	5,000	18,000					18,000		
Priority Customer Service Improvements	3,000	3,000	3,000	3,000	12,000	2,000	2,000	1,000	1,000	6,000		
Subgrade Rehabilitation Programs												
Subgrade Slab Rehabilitation Phase 1	6,000	0	0	0	6,000						6,000	
Subgrade Slab Rehabilitation Phase 2	1,000	5,000	5,000	5,000	16,000						16,000	
Subgrade Code Upgrade Projects	1,000	1,000	1,000	1,000	4,000						4,000	

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WORLD TRADE CENTER - PROPOSED 2002-2005 CAPITAL PLAN - ROUGH BREAKDOWN BY BUILDING

($'s in thousands)

Proj Title	2002	2003	2004	2005	2002-2005	Bldg 1	Bldg 2	Bldg 4	Bldg 5	Retail Mall	Subgrade	Central Sys.
Security Programs												
Office Space Security System	250	250	250	250	1,000	400	400	100	100			
Security Modernization Projects	3,000	3,000	3,000	3,000	12,000							12,000
Elevator and Escalator Modernization Programs												
Elevator Control Modernization - Tower 1	3,500	3,500	3,500	3,000	13,500	13,500						
Elevator Control Modernization - Tower 2	3,500	3,500	3,500	3,000	13,500		13,500					
Asbestos Abatement Shuttle Shafts	500	500	500	500	2,000	1,500	500					
Elevator Disconnect Switches	500	0	0	0	500	250	250					
Tenant Space Prep/Landlord Work Projects												
Lease Obligated Capital Work	2,000	3,000	3,000	3,000	11,000	4,000	4,000	1,000	1,000	1,000		
Multi-Tenant Floor Corridor & Restrm Rehab	3,000	3,000	3,000	2,000	11,000	4,500	4,500	1,000	1,000			
Building Infrastructure Rehabilitation Programs												
Priority Capital Major Work Projects	500	500	500	500	2,000							2,000
Capital Major Work Projects	5,000	5,000	5,000	5,000	20,000	2,000	2,000	500	500			15,000
Other Asbestos Abatement	500	500	500	500	2,000	600	600	150	150		500	
ADA Projects	250	250	250	250	1,000	100	100			800		
GRAND TOTAL	61,750	60,000	61,500	58,500	241,750	36,450	37,450	6,800	6,750	53,800	36,500	64,000

Draft - 11/3/00

ATTACHMENT 6

R.W. Crandlemere & Associates Environmental Site Assessment Phase I Report
(Separate binder)

ATTACHMENT 7

BOCA Group International, Overall Observation

BOCA GROUP
INTERNATIONAL, INC.
VERTICAL TRANSPORTATION CONSULTING

December 5, 2000

Mr. Robert Weiland
Merritt & Harris
110 East 42nd Street
Suite 1200
New York, NY 10017-5685

RE: ONE, TWO, FOUR & FIVE WORLD TRADE CENTER
OVERALL OBSERVATION

Dear Mr. Weiland:

Our engineers performed a visual observation and reviewed contracts and documentation, as listed below, of the elevators at the above referenced projects. The elevators and escalators were observed on a "specimen sample" basis. A few units from each building were observed, and these were broken down into units where the "complete modernization" was finished and units where modernization had not been performed as of November 1, 2000. According to the specifications, the modernization is being performed in two phases, the Overlay Modernization Phase and Complete Modernization Phase.

List Of Documents Reviewed

We also reviewed a few documents at the Port Authority Vertical Transportation Office. The following is a list of the documents we observed:

1. World Trade Center Property Book
2. Offering Memo
3. The Port Authority of NY and NJ
   - The World Trade Center Contract WTC – 845-071 "Modernization of Elevators, Dumbwaiters and Escalators @ One World Trade Center" March 1994
   - The World Trade Center Contract WTC – 838-071 "Modernization of Elevators and Escalators @ Four and Five World Trade Center" September 1993
   - The World Trade Center Contract WTC – 846-071 "Modernization of Elevators and Escalators @ Two World Trade Center" March 1994

200 PARK AVENUE • NEW YORK, NY 10166
TELEPHONE (212) 983-7010 • FAX (212) 983-7011 • E-MAIL info@bocagroup.com
www.bocagroup.com

- Maintenance Contract for World Trade Center - 799.700 Maintenance.

4. VDA Maintenance Surveys
   i. dated June 14, 2000 (Elevators 1A – 5A, & 8A – 11A
   ii. dated August 2, 2000 (WTC tower "B" Local Elevator nos. 63, 64,65,66,67 & 68)
   iii. dated August 21, 2000 (Elevators 81B – 86B)
   iv. dated October 16, 2000 (Elevators 75B – 85B in Two WTC)

5. Correspondence dated October 17, 2000 from the Port Authority to ACE Elevator Company.

6. Monthly callback summaries on elevators with greater than two outages (April, May, June, August, September and November, 1999; January –May 2000 and July –October 2000) for One World Trade Center and Two World Trade Center.

7. OCC DECK Reports dated 10/16/00 and 11/1/00.

FORM OF REPORT:

Following this overall observation, is a summary of the scope of work included in the modernization of the elevators located within the World Trade Center.

A status of the elevator modernization program follows the overall observations. The sub-grade units are listed immediately following the status report, which is followed by a listing of the tenant units and the retail units that we observed in the layout drawings.

A section discussing the current maintenance being performed follows the previously described sections.

Detailed reports on the individual buildings follow the status of the elevator modernization. These reports describe the equipment that we observed and also list information that we gleaned from the documents that we reviewed.

At the end of each section are the traffic calculations and analyses for the various buildings. Please note that these calculations do not include any of the tenant owned and operated elevators

The following sections include reports for the individual buildings.

GENERAL NOTES

The four buildings have a total of 238 elevators 126 of them have been modernized, 8 already in progress and 104 not yet started but scheduled for a future date. Most of the modernized elevators have SCR Drives with CEC Swift Futura Controllers, door operators retrofitted with solid state controls to interface with the new controllers all

giving the elevator better service and a better quality ride. All passenger elevators have had cab refurbishing, all but two are ADA compliant.

Due to a previous elevator incident at Two World Trade Center elevators 18-23B were excluded from our inspection.

Five tenant owned and operated elevators were not observed and form part of this report by reference only.

Upon inspection of the hoistway we observed the hoistway doors are fire rated with UL certification labels. To provide a statement on the hoistway walls being fire rated, a sampling would be necessary. This was not performed during our inspection which was of a visual nature.

All Escalators have been modernized with start/stop switch, comb plate switch, demarcation lights, caution signs, controlled descent devices, remote monitoring system, Carl White device (new for every device).

The PATH Escalators are excluded from the scope of this report.

SPECIAL ELEVATOR FEATURES

Track and saddle inserts have been installed predominately in tower shuttles and D Bank reducing friction between saddle and gibs minimizing stack effect problems on elevators.

Buildings One World Trade Center and Two World Trade Center provide a warning device, located on the 108 Floor, which rates the wind sway that automatically reduces the speed of the elevators to prevent possible damages. Accordingly, the shuttle elevators have the ability to have speed reduced automatically from 1600 Feet Per Minute to 1000 Feet Per Minute whenever strong wind conditions are observed and a warning system is activated as described below.

In buildings One World Trade Center and Two World Trade Center, elevators Nos. 14 and 15 have hoistway wall roller followers, which have proven to be successful in minimizing wall erosion due to rope contact. The followers are installed on all the high-rise shuttles, elevator Nos. 6 and 7 in each tower.

In all buildings the elevators can be recalled down to their respective lobbies via the elevator start consoles.

We hope you find this report useful in the due diligence analysis of the aforementioned properties. If you have any questions, please call the undersigned at (212) 983-7010

Sincerely,

BOCA Group International, Inc.,

Vish Shetty

Elevator Modernization – Summary of Scope of Work
(As of 11/1/2000)

Shuttle Elevators

Removal of existing equipment, designing, fabricating, delivering and installing an operating overlay prior to ordering full modernization.

Removal of existing equipment, designing, fabricating, delivering and installing a complete modernized elevator.

Remove existing motor generator, design, deliver and install new silicone controlled rectifier (SCR) power conversion units.

Design, fabricate, deliver and install revised emergency power operation line starter selection.

Removal of existing hall call fixture and designing, fabricating, delivering, and installing of a new hall call fixture.

Removal of existing hall lanterns and designing, fabricating, delivering and installing of new hall lanterns.

Removal of existing jamb markers and designing, fabricating, delivering and installing of new jamb markers.

Design, fabricate, deliver and install new car to lobby (CTL) key switch with updated wiring changes.

Local Elevators

Removal of existing equipment, designing, fabricating, delivering and installing an operating overlay prior to ordering full modernization.

Removal of existing equipment, designing, fabricating, delivering and installing a complete modernized elevator including SCR drives and microprocessor based controllers.

Design, fabricate, deliver and install new car to lobby (CTL) key switch with updated wiring changes.

Design, fabricate, deliver and install revised emergency power operation line starter selection.

Removal of existing hall call fixture and designing, fabricating, delivering and installing of a new hall call fixture.

Removal of existing hall lanterns and designing, fabricating, delivering and installing of new hall lanterns.

Removal of existing jamb markers and designing, fabricating, delivering and installing of new jamb markers.

Freight Elevators

Removal of existing equipment, designing, fabricating, delivering and installing an operating overlay prior to ordering full modernization.

Removal of existing equipment, designing, fabricating, delivering and installing a complete modernized elevator including SCR drives and microprocessor based controllers.

Removal of existing door protective devices and designing, fabricating, delivering and installing of door protective devices.

Provide new freight elevator hall lanterns at each landing served. This includes designing, fabricating, delivering and installing new hall lanterns.

Removal of existing jamb markers and designing, fabricating, delivering and installing of new jamb markers.

Status of WTC Elevator Modernization Program
(as of 11/1/2000)

	1 WTC		
	Complete	In Progress	Future
Local	56	3	13
Low-Rise	0	0	8
High-Rise	6	0	7
Freight	2	0	4

	2 WTC		
	Complete	In Progress	Future
Local	37	2	33
Low-Rise	0	0	8
High-Rise	6	2	5
Freight	1	0	5

	4 WTC		
	Complete	In Progress	Future
Local	11	0	1
Freight	0	0	2

	5 WTC		
	Complete	In Progress	Future
Local	7	1	1
Freight	0	0	2

SUBGRADE		
Complete	In Progress	Future
0	0	15

SUB-GRADE ELEVATORS

ELEVATORS SERVING SUB-GRADE ONLY

ELEVATOR	FLOORS SERVED
K2	Front: B1 Rear: B4, B5, B6
K1	1, B1
FE5	B1-B3
FE8	43-44
J4	1, B1
FE1	B2, B1, 1
FE2	B2, B1, 1
FE3	B1, 1, 2-9
FE4	B1, 1, 2-9

ELEVATORS SERVING SUB-GRADE IN ADDITION TO OTHER FLOORS

ONE WORLD TRADE CENTER

ELEVATOR NUMBERS 50, 7, 49, 17, 48, 5, ARMOR CAR, ALL "J" CARS, 36, 41, 42, 47, 35, 30, 29, 24.

TWO WORLD TRADE CENTER

ELEVATOR NUMBERS 50, 7, 49, 17, 48, 5, ARMOR CAR, ALL "K" CARS, 36, 41, 42, 47, 35, 30, 29, 24.

TENANT ELEVATORS AND ESCALATORS

FIVE WORLD TRADE CENTER

UNIT TYPE	UNIT NUMBER	FLOORS SERVED	# OF UNITS
ESCALATOR	CSE 1 AND CSE 2	2 TO 3AND 3 TO 2	2
ESCALATOR	NONE	1 TO 2, 2-3 AND 3-2	3
HYDRAULIC ELEVATOR	BORDERS BOOK STORE	1,2,3	1

FOUR WORLD TRADE CENTER

UNIT TYPE	UNIT NUMBER	FLOORS SERVED	# OF UNITS
ELEVATOR	1 AND 2	1, 3, 4, 5 6	2
ELEVATOR	SWISS BANK	NOT AVAILABLE	1

RETAIL ESCALATORS

We have been informed by the Vertical Transportation Department of the Port Authority of NY and NJ that these units incur unusually high maintenance costs due to high traffic volume and also due to the fact that these escalators are used to transport handcarts and other wheeled carriages.

ONE WORLD TRADE CENTER

NONE

TWO WORLD TRADE CENTER

NONE

FOUR WORLD TRADE CENTER

ESCALATORS NEAR LIBERTY STREET BETWEEN HSBC ATM AND NEWS STANDS (2 UNITS) (E14 AND E15)

ESCALATORS BETWEEN AU BON PAIN (E17 AND E18), VICTORIA'S SECRET AND BATH AND BODY WORKS

FIVE WORLD TRADE CENTER

CONCOURSE TO PLAZA (E19 AND E20)

ESCALATORS BETWEEN NINE WEST AND TOURNEAU STORES (2 UNITS) (E1 AND E2)

ESCALATORS TO SIX WORLD TRADE CENTER NEXT TO CHOICE COURIER (2 UNITS)

ELEVATOR MAINTENANCE

We performed a visual inspection of the 21 pre-selected elevators and a few escalators in buildings One, Two, Four, and Five World Trade Center, we have gathered that the equipment has to be closely monitored by the Vertical Transportation Department of the World Trade Department. We have also reviewed maintenance evaluation reports submitted by an independent third party based upon their field observations. These reports indicate deficiency items mostly related to house keeping, some of which remain to be corrected. The indications on the third party reports in reference to the preventive maintenance practices range from "acceptable" to "marginally acceptable" with "definite room for improvement in the area of housekeeping". Nevertheless, it appears from the correspondence we observed and during our general discussions that a great deal of close monitoring and follow up from the Vertical Transportation Department is required for the elevator maintenance company to respond to schedule requests as well as perform preventive maintenance. We understand that the elevator company does not inform the PA about any past problems or future repairs that need to be scheduled as a result of which the problems persist.

Additionally, we reviewed the maintenance callback sheets listed previously after which we performed a visual inspection of additional machine rooms in One World Trade Center and Two World Trade Center. This field visit revealed a large amount of rouged cables and bad machine bearings. The rouged cables are contributing largely to the amount of dust and dirt in the machine room, on the machine room equipment and secondary equipment. This condition will most likely cause contact failures, electrical shorts and other potential hazards to the equipment and its workers. There was a significant amount of bad machine bearings observed which are causing noise and vibration in the machines. If this is not corrected soon more serious damage will be caused to the hoist machines.

It was also noted that a few elevators had temporary jumpers on the controller, which is not a generally accepted practice in the elevator industry and could be potentially dangerous.

The following section describes some of the significant deficiencies that we observed all of which are covered under the full-service maintenance contract in effect.

SIGNIFICANT MAINTENANCE ITEMS

ONE WORLD TRADE CENTER

Major Maintenance Items:

1. Excessive dust in all machine rooms observed
2. Rouged cables on Elevators 74, 1, 4, 66, 58, and 60
3. Cables with breaks on Elevators 63 and 64

4. Defective machine bearings on Elevators 72, 46 and 61

Other Maintenance Items:

Elevators Nos. 63 - 68:
Elevator No. 63 - Many breaks in cables.
Elevator No. 64 - Many breaks in cables.
Elevator No. 65 - Relevels many times, Cables are filthy
Elevator No. 66 - Slightly rouging of hoist cables.
Elevator No. 68 - Excessive carbon dust in hoist motor.

Elevators Nos. 57 - 62:
Elevator No. 58 - Cables have excessive rouging - all in machine.
Elevator No. 59 - Carbon dust excessive in hoist machine.
Elevator No. 60 - Rouge in cables
Elevator No. 61 - Vibration in main bearing and excessive carbon dust in machine.

Elevators Nos. 49, 69 - 74:
Elevator No. 49 - Four temporary jumpers on controller. Large amount of dust in hoist machine and motor.
Elevator No. 69 - Excessive rouge dust in hoist machine.
Elevator No. 72 - Bad main bearing - whole machine rocks.
Elevator No. 73 - Rouge dust around and in internal brake.
Elevator No. 74 - Excessive cable rouge - all over and in machine.
Rouge on Machine room floor.

Elevator No. 16 - Cable has broken lay. Secondary rouged cables - rouge all over machine room. We were informed that one of the hoist cables broke, started untwisting and came in contact with metal causing a spark, which started a fire in secondary. Elevator shut down for repairs.

Elevator No. 74 - Cables rouged - Rouge all over machine room.

Elevator No. 72 - Bad main bearing - machine rocks.

Elevator No. 1 - Excessive cable rouging condition and excessive oil on brake pads.

Elevator No. 4 - Excessive cable rouge.

Elevator No. 46 - Bad main bearing and cables are rouged.

TWO WORLD TRADE CENTER

Major Maintenance Items:

1. Rouged cables on Elevators 8, 9, 63-68 ,72, 2, 7, K5, 26 and 28.
2. Bad machine bearings on Elevators 11, 56, 73 and 26
2. Excessive dust in machine room.

Other Maintenance Items:

Elevators Nos. 1-5:
No. 1 Elevator - Carbon dust in hoist motor - cables rouged all over. Oil on brake pads.
No. 2 Elevator - Cables rouged all over - Pie Plate Selector very noisy.

Elevators Nos. 6, 7, 50 and 99: Carbon dust in all hoist motors
No. 6 Elevator - Oil on brake pads.
No. 7 Elevator - Rouged cables caused excessive rouge deposits all over machine.
No. 49 Elevator - Jumper on controller, rouge all in controller, carbon dust excess in hoist motor.

Elevators Nos. 12 - 17: Dust in all machines
Elevator No. 16 - Excess carbon dust in hoist motor & rouge on drive sheaves.
Elevator No. 14 - Car oil seepage in main bearing sheave side

Elevators Nos. K3 - K5:
Elevator No. K5 - Rouge on cables - Not bad.

Elevators Nos. 24-29:
Elevator No. 26 - Bad main bearing and cable rouging.
Elevator No. 28 - Cable have rouging - rouge in hoist machine.
Elevator No. 27 - Rouge dust in hoist machine.

Low Rise Shuttles
Elevator No. 8B - Cables rouged causing rouge all over machine room.
Elevator No. 9B - Cables rouged causing rouge all over machine room.
Elevator No. 10B - Low Brushes and rouge all over machine room.
Elevator No. 11B - Bad main bearing and rouge all over machine room.

Elevators Nos. 51 - 56:
Elevator No. 56 - Bad main bearing

Elevators Nos. 57 - 62:
Elevator No. 62 – Full size hoist motor brushes are not in contact with commutator. Many brushes are low.

Elevators Nos. 63 - 68:
Elevator No. 63 - Cables rouged.
Elevator No. 64 - Cables rouged.
Elevator No. 65 - Cables rouged.
Elevator No. 66 - Cables rouged causing rouge all over hoist machine.
Elevator No. 67 - Cables rouged causing rouge all over hoist machine.
Elevator No. 68 - Cables rouged all over, and oil leak in main bearing.

Secondary – There are thick amounts of rouge all over. Generator copper shavings inside and carbon excessive

Elevators Nos. 69 - 74:
Elevator No. 72 - Car cables rouged; rouge all over machine room.
Elevator No. 73 - Main bearing real bad, whole machine shakes.

MAINTENANCE ITEMS

The two OCC Deck reports show many long outstanding maintenance items, some dating as far back as March 2000. This is indicative of poor response from the elevator company.

CALLBACKS

The following charts summarize the callback information that was provided to us as indicated in item #6 under the list of documents reviewed.

A review of the charts will indicate an excessive amount of callbacks on both old units and new units. Although all callbacks may not be attributed to poor maintenance, they are a good indicator of preventive maintenance and while difficult to eliminate totally, can be minimized with a good maintenance program in place. The excessive callbacks shown on the charts for some units are especially unacceptable on the modernized elevators. (The average number of callbacks (>2 only) for new units (for 15 months) is 5.75 for One World Trade Center and 3.45 for Two World Trade Center). As per one of the major elevator manufacturers and installers, an acceptable shutdown frequency for a controller related problem would be one per year per elevator.

ELEVATORS WITH >2 CALLBACKS

MONTH	ONE WORLD TRADE CENTER			TWO WORLD TRADE CENTER		
	OLD UNITS	NEW UNITS	TOTAL	OLD UNITS	NEW UNITS	TOTAL
Apr-99	73	9	**82**	48	3	**51**
May-99	45	13	**58**	58	14	**72**
Jun-99	58	22	**80**	34	13	**47**
Aug-99	29	20	**49**	17	10	**27**
Sep-99	20	29	**49**	36	14	**50**
Nov-99	34	46	**80**	40	14	**54**
Jan-00	21	9	**30**	32	10	**42**
Feb-00	34	15	**49**	18	16	**34**
Mar-00	34	37	**71**	51	10	**61**
Apr-00	16	29	**45**	31	18	**49**
May-00	30	25	**55**	29	6	**35**
Jul-00	25	37	**62**	29	6	**35**
Aug-00	25	14	**39**	29	7	**36**
Sep-00	6	21	**27**	21	4	**25**
Oct-00	17	42	**59**	44	7	**51**
TOTAL	**467**	**368**	**835**	**517**	**152**	**669**

TOTAL UNITS WITH >2 CALLBACKS		
	ONE WORLD TRADE CENTER	TWO WORLD TRADE CENTER
Apr-99	15	10
May-99	11	14
Jun-99	18	11
Aug-99	11	7
Sep-99	8	11
Nov-99	17	14
Jan-00	9	10
Feb-00	13	7
Mar-00	17	12
Apr-00	8	13
May-00	13	10
Jul-00	10	12
Aug-00	11	8
Sep-00	7	5
Oct-00	13	11

SECTION V – EXISTING PROPERTY DESCRIPTIONS & CONDITIONS

A. Overall Project

Building Type	Commercial Office Building
Built-Circa	1972
Certificate of Occupancy	A Certificate of Occupancy has not been issued by the City of New York because property owned by the Port Authority is not subject to the Building Code of the City of New York. We have observed "Permits to Use or Occupy" issued by the Port Authority for specific work, notably the October 10, 1997 Permit issued following completion of repairs following the 1993 bombing, but the Port Authority did not routinely issue the equivalent of a Base Building Occupancy Certificate until January 1992. In addition, in December 1995, the Port Authority (PA) started an optional "Self Certification" program for alteration work by tenants. The PA has issued "Consent to Occupy" for specific work under this program.
Story Height	12' 0" typical office story 14' 0" at sky lobbies 28' (2-story) at mechanical equipment rooms (MER)
Number of Stories	110 stories plus 6 subgrade levels
Building Height	The overall building height from lobby level to the roof is 1,362'
Total Sq. Ft. (Bldg. Area)	42,900 gsf (gross sq. ft.) footprint calculated 4,761,416 gsf (1968 REBNY) 4,470,598 gsf (remeasured by REBNY 1987 Guideline) 4,173,612 rsf (May 31, 2000 Rent Roll sq. ft.)

General Breakdown of Floor Uses

Floors	Predominate Uses
Roof Level	Outdoor Observation Deck
110	Tank Rooms, Elevator Equipment Rooms, Broadcasters
108-109	Mechanical Equipment Rooms, Elevator Machine Rooms
107	Observation Deck Facilities
79-106	Offices
78	Sky Lobby, Offices
77	Offices, Elevator Pits
75-76	Mechanical Equipment
45-74	Offices
44	Sky Lobby, Offices
43	Dean Witter Cafeteria, Offices, Elevator Pits
41-42	Mechanical Equipment
9-40	Offices
7-8	Mechanical Equipment
3-6	Core Area, Lockers
Plaza Level	Main Entrance Mezzanine from Plaza
Lobby	Main Entrance Lobby from Concourse
B-1	Storage, Truck Dock Access, Elevator Pits
B-2	Storage and Maintenance Subcontractors, Elevator Pits, Parking Access
B-3	Storage and Maintenance Subcontractors, Elevator Pits, Parking Access
B-4	Storage and Maintenance Subcontractors, Elevator Pits, Parking Access
B-5	Mechanical Equipment and PATH ROW
B-6	Mechanical Equipment and PATH ROW, Elevator Machine Room

Special Features

The building is the 2nd tallest building in New York City and among the tallest in the World. It contains the rooftop helicopter pad, a rooftop outdoor observation promenade and the 107th floor indoor observation facility, which provide spectacular views of New York City and its harbor, including the Statue of Liberty. Office space is column free, with up to 60' spans between the core and facade. A feature of the public mezzanine space is the TKTS Booth, where 1/2-price tickets for New York City theater are available.

Design Team

Architects	Minoru Yamasaki & Associates Emory Roth & Sons
Structural Engineer	Skilling-Helle-Christiansen-Robertson
Slurry Wall	Port Authority
Mechanical Engineer	Jaros Baum & Bolles
Electrical Engineer	Joseph Loring & Associates

Recent Renovations

Sprinkler installation for LL 5/73 compliance

Fire alarm system modernization

47% elevator system modernization completed, including cabs, controllers, SCRs, ADA panels, with phased upgrading planned over the next 4 years.

Electric Power Upgrade - 1999

Chilled water risers

Condenser water upgrade

B. Project Condition

Overview

The building maintenance is supervised by the Port Authority who retains a service contractor (ABM) to perform routine and special maintenance of equipment in common areas through a consolidated performance based contract. The Port Authority retains consultants to prepare evaluation reports on the major systems in the building.

Structure

Where they could be seen, the building's structural elements appeared free from signs of distress, deterioration, or building settlement. Structural Integrity Inspections (SII) have been performed by Leslie E Robertson Associates (LERA) and other engineering firms on many of the structural components of all the buildings in the World Trade Center. Deficiencies typically noted are rusting conditions in the steel columns in the elevator shafts, missing fireproofing, and occasional floor coring damage.

LERA recommends that the analysis of wind acceleration measurements be continued to monitor the dynamic behavior of the structure. They note that the 30-year-old visco-elastic dampers on the floor open web trusses have a finite life and must continue to be monitored.

Visco-elastic dampers located at each floor joist at the connection to the perimeter columns dampen the sway motion. Sample dampers are tested every 5 years, most recently in 1996. It is reported that approximately 2 dozen dampers are kept in stock for replacement.

Building Exterior

The building facade appears in good condition with no reported leaks. The facade is regularly inspected and repaired on an ongoing 5-year cycle, with 10% of facade monitored by LERA to insure quality control. SII reports are issued annually to the Port Authority. Recent SII reports note that the window gasketing is starting to exhibit age related deterioration. Wet sealing (sealant placed over gasket) is anticipated within 10 years.

The clear lacquered coated anodized aluminum column covers exhibit finish color variations between panels.

The 110th story facade slopes inward and extends above the roof level to form the roof parapet. The steel supports are rusting and repainting is required.

Roofs

The main roof is the original membrane (reportedly asphalt felt built-up system) and is protected by 2" of rigid insulation and a 5" concrete overlay. The roof reportedly does not leak.

There is ponding observed in some locations on the roof in the window washing rig track area, requiring some concrete or asphalt build-up to correct. The concrete overlay is displaying age- and exposure-related deterioration, and a top coating is anticipated within the next 5 years.

The rooftop rails for the window washing rig, the metal fencing, and the metal stair components are rusting and require repainting.

Interiors

Multi-tenant floor common area finishes are typically average quality and are adequately maintained. Corridor carpets are reportedly 2 years old. Elevator vestibules are good durable quality. Most corridors have concealed spline acoustic ceiling tiles and many are displaying age- and usage-related wear, and replacement should be anticipated. Most toilet rooms are original durable finishes, with localized repairs for cracked tile or damaged tile required, as ordinary maintenance. A capital program was initiated to upgrade multi-tenanted corridors and toilet rooms. Approximately 6 floors have been completed.

Full floor tenants maintain higher quality elevator vestibule and corridor finishes.

The 3 stair exit shafts typically display age- and usage-related wear and require floor repainting. Photo-luminescent paint stripes in stairs are recommended to be retained. The nosings on Stair B (wide stair) are bent outward in isolated locations and require repair. This condition occurs in both Towers.

The 110th floor tank room requires cleaning and painting. Mechanical equipment floor on Level B-6 requires floor repainting.

Vertical Transportation

The elevators appear adequately designed and are maintained under service contract. Passenger cabs were recently renovated, including cab interiors, ADA accessible front panels, and non-contact cab door safety edges. Escalators have been modernized with start/stop switches, comb plate switches, demarcation lights, caution signs, controlled descent devices, and remote monitoring systems.

Approximately 45% of the controllers and motor generators have been modernized with another 5% in progress. The remaining equipment has exceeded its functional useful life expectancy and continuing modernization is expected to be complete by the 2nd quarter of 2004.

High zone Express Elevator 16 requires ADA car control panels.

HVAC

The mechanical systems are adequately designed, using brand-name equipment, which provides adequate cooling for the office areas. To allow for the expanded substations in the 75th floor MER, 2 AHUs were removed and new AHUs were installed. The original freeze protection system for the AHUs and reheat system for the heating hot water system have been abandoned in place, and consideration should be given to removal of the equipment for these systems. A new freeze protection system will be installed in all of the MERs over the next 5 years. The equipment has been well maintained, nearly all equipment is original (28 years old), and has or will exceed its published service life over the next 10 years, and replacement should be anticipated. A recent capital program to update the HVAC air-handling equipment has effectively increased the anticipated service life of the equipment. Equipment or component maintenance and repair is performed as part of the ABM service contract.

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Plumbing

There have recently been problems with the failure of water hammer arrestors and leaks (see the Executive Summary). Although in operation, replacement of pumps, and water heaters should be anticipated over the next 10 years. Equipment or component maintenance and repair are performed as part of the ABM service contract.

Electrical

An adequate 10 watts/sq. ft. is provided from the 58th floor through the 92nd floor. Six-watts/sq. ft. is available in the remaining areas of this Tower.

Life Safety

The life safety systems meet code requirements for modern hi-rise office buildings. The building has completed sprinkler installation for compliance with LL5/73, and is in process of installing a Class "E" fire alarm system.

Property Maintenance

The in-house maintenance is performed by a service firm retained by the Port Authority. Electrical, HVAC, and general maintenance is performed under the terms of a consolidated performance based service contract by ABM Engineering with oversight by the Port Authority group World Trade Department's Building Services Management Division. In general, maintenance appears to be adequate. Housekeeping deficiencies were noted in stairwells and service areas. Some mechanical equipment room floor slabs require refinishing. Exposed rooftop ferrous metals require better maintenance.

Accessibility

The building's entrances and elevators (except 1 high zone express elevator) are substantially ADA compliant. Some toilet rooms on multi-tenanted floors are (25% estimated) ADA compliant. A program of upgrading was started 2 years ago. ADA compliance on most full tenant floors is reportedly the responsibility of the tenant under terms of the lease.

Violation Status

As stated in the Offering Memorandum, "The Port Authority is a municipal corporate instrumentality and political subdivision of the States of New York and New Jersey which provides transportation, terminal, and other facilities of commerce within the Port District. As such, in connection with the Transaction, the PA will continue to maintain exclusive jurisdiction with respect to certain administrative and governmental matters involving the Complex, including compliance with building, environmental, fire and health codes." The New York City Department of Buildings has indicated that they do not maintain any records of violations for this property. A request for a Property Profile Overview for this block and lot number yields no records. The Fire Department provides normal fire fighting and a life safety

service to the facility. A Memorandum of Understanding exists between the Port Authority and the Fire Department in which the Fire Department performs regular inspections and directly notifies the Port Authority Fire and Life Safety group of deficiencies to be corrected. Under a protocol with the New York City Fire Department, Port Authority Police personnel investigate certain fire alarms at the World Trade Center rather than transmitting such alarms to the New York City Fire Department.

C. Site

Site information for all of the buildings is included within the Executive Summary section.

D. Building Description

1. Structure

Foundation

The foundation of Building 2 is situated within a common 6-level deep (70') subgrade space (1 WTC, 3 WTC, and 6 WTC), which is enclosed by 3' thick concrete cut-off walls installed by the slurry trench method.

Drawings indicate the Tower foundation under the building's columns consists of steel bearing plates and 2-way steel grillage placed on concrete leveling fill bearing on 40 tsf capacity bed rock, located under the B-6 cellar level.

Slab-on-Grade

Level B-6 floor slabs are concrete slab-on-grade placed over porous fill on bedrock.

Superstructure

The building structure is steel built-up box-shaped columns at the exterior perimeter, and box-shaped or wide-flange columns at the central core area. Columns are 10' o/c at the base and tree outward into 3' 4" spacing up the full height of the building. Structural steel spandrel girders are installed between the columns. Doubled, 29" deep, open web joists spaced at 6' 8" o/c span from core to the exterior columns. Exterior columns between the open web joists are stabilized by 2 diagonal angle braces cast into the slab and attached to the adjacent trusses.

The Tower columns, girder, and floor joists are fire protected with spray-on fireproofing. Basement area steel girders and beams are encased in concrete.

The roof structure is referred to as The Crown and it serves to stabilize the exterior columns. It is formed with structural steel trusses for rigidity. Identified lead paint may require future abatement. The interior section of the roof slopes up above the perimeter roof level.

Lateral wind loads are resisted by the 207' square hollow tube effect created by the rigidity of the closely spaced exterior columns and rigid spandrel girders connecting the columns. Wind sway movements on the top story reportedly approach 3'. Visco-elastic dampers located at each floor joist at the connection to the perimeter columns dampen the sway motion.

Floors

The typical office story floor has 1 1/2" deep metal form deck, with cellular raceways for electrical and communication wiring, and 4" lightweight concrete slab with steel reinforcement. The typical floor core area, and the basement slabs are 4 1/2" normal weight reinforced concrete slab, acting compositely with beams and girders.

The roof is reinforced concrete slab.

Other

There is a helicopter pad mounted on the roof, but no specific weight capacity was furnished.

Design Loads

The following live loads are noted on the drawings or in the SII reports or PA Design Guidelines:

Area	Live Load (psf)
Roof	40 psf
Office*	100 psf including partitions
Stairs and Public Areas	100
Mechanical	75
Wind	Wind tunnel
Seismic	Not applicable

* Reducible

Condition

Where not concealed by building finishes, the building structure appears to be in good overall condition. There is no apparent movement or settlement in foundations. Interior slabs appear in good condition. Basement areas under the Tower were dry.

SII of various structural systems have been performed on a regular basis by Leslie E Robertson Associates (LERA) and other engineering firms, at all WTC buildings. Deficiencies typically noted are light rusting conditions in the steel columns in the elevator shafts, missing fireproofing, and occasional floor coring damage. The most recent SII recommended repairs are underway.

Visco-elastic dampers located at each floor joist at the connection to the perimeter columns dampen the sway motion. Sample dampers are tested every 5 years, most recently in 1996. Retesting is scheduled this year. It is reported that approximately 2 dozen dampers are kept in stock for replacement.

LERA strongly recommends that the analysis of wind acceleration measurements be continued, to monitor the dynamic behavior of the structure. They note that the 30-year-old visco-elastic dampers on the floor open web trusses have a finite life and must continue to be monitored.

2. Exterior

Walls

The building has a square shape, 207' 2" on each side. The facade of the building extends up 1,362' from Concourse lobby level to the roof. The exterior columns are projecting, and are spaced 10' o/c from Plaza Level to the 6th story, where each column transitions to 3 columns, spaced at 3' 4" o/c. Columns are covered with rectangular-shaped anodized aluminum column covers, with built-in window washing tracks. Spandrel panels between windows are black colored, painted aluminum.

The 110th story facade slopes inward, and extends above the roof level to form the roof parapet.

Windows

Fixed glazed vision glass fits between the column covers (approximately 1' 10" wide and 7' 8" high.). The glass is single pane. Window treatments include venetian blinds.

Window Cleaning Equipment

There is a window-washing rig that rides on rooftop tracks extending around the roof perimeter. There is a platform that lowers the rig from the roof rails into the interior garage on the 110th floor. A special platform to access the Tower's corners is already on-site and installation is beginning. It is anticipated that the platform will be ready for use next year.

The rig operator can lower the robotic window washing apparatus, or the manned scaffold platform. Stainless steel tracks for the robotics window washing apparatus and the manned platform are built into the facade column covers.

Doors

There is a street entrance at Liberty Street, which enters into the lobby level vestibule. The entrance has 2 revolving doors, 3 pairs of swing doors, and 1 pair of automatic sliding doors for persons with disabilities.

The front entrance to the building is located facing toward the north, opening onto the main plaza. There are 2 revolving doors and 2 pairs of swing doors at this location. There are 2 additional sets of doors on both the east and west side that provide egress to the plaza. The east also has an extra set of doors that lead to a bridge adjacent to at WTC 4.

Revolving doors and swing doors are set between exterior columns, with overhead glazed fixed transoms. All doors have polished stainless steel framing.

Thermal Insulation

Spandrel panels have rigid insulation on the internal face.

Weatherproofing Sealants

There is elastomeric sealant at the juncture of vertical column cover sections. There is rubber gasket glazing for the glass vision panels and glass spandrel panels.

Expansion/Control Joints

Facade expansion joints were not observed, but the column cover system has many components with elastomeric sealants and its expansion and contraction is self-relieving.

Other

The close spaced columnar design of the exterior facade is dictated by structural considerations due to the unique extreme height of the building and the requirement for column-free interior tenant space.

Condition

The building facade appears in good condition with no reported leaks. The facade is regularly inspected and repaired on an ongoing 5-year cycle, with 10% of facade monitored by LERA to insure quality control. SII reports are issued annually to the Port Authority. Recent reports note that the window gasketing is starting to exhibit age related deterioration, and wet sealing is anticipated within 10 years.

The lacquer-coated anodized aluminum column covers exhibit finish variations between panels.

The 110th-story facade slopes inward and extends above the roof level to form the roof parapet. The steel supports are rusting and repainting is required.

Heitmann & Associates Facade Survey Report is Attachment 9.

3. **Roof**

Roof Area

The main roof is above the top (110th) story of the building. There is also roofing at the parking area for the window-washing rig on the 110th floor. The exterior walls of the 110th story step back for air intake louvers. The mechanical rooms on the 108th, 75th, 41st, and 7th stories step back 6' to conceal the louvers. The setbacks have roofing membrane.

The exterior steel-framed observation deck is located on the roof, with an electrified security fence to prevent access to the roof.

System

The main roof is the original membrane (reportedly asphalt felt built-up system) and is protected by 2" of rigid insulation and a 5" concrete overlay. Setback roofs appear similarly constructed. The setback concrete surfaces were covered with traffic deck membrane in 1995 due to leaks.

Decking

The roof deck is reinforced concrete. The roof slab is sloped up above the central core area of the building.

Drainage

The roofs have internal roof drains.

Parapets/Copings

There is a 3' inward sloping perimeter parapet wall adjacent to the window washing rig tracks. The parapet is the exposed steel facade framing and aluminum facade panel.

Flashing

All flashings are flashing membrane extended up and under metal cap flashing set in reglets in concrete curbs

Expansion Joints

None observed

Penetrations and Equipment Mounting

Penetration flashings are concealed under the concrete topping

Access

The roof is accessed from the 110-story vestibule, which opens to an exterior stair to the roof.

Skylights — There are no skylights.

Bonds/Warranties — All warranties are expired.

Condition — The main roof, although the original membrane, is protected by a 5" thick concrete overlay, and a large portion is pitched. The roof reportedly does not leak, and should last beyond 10 years. The concrete overlay is displaying age- and exposure-related deterioration, and a top coating is anticipated within the next 5 years.

There is ponding observed in some locations on the roof in the window washing rig track area, requiring some concrete or asphalt build-up to correct.

The rooftop rails for the window-washing rig and the exterior metal stair components are rusting and require repainting. The observation deck fencing requires repainting.

The concrete fill at the exterior walkways, at the mechanical equipment room setbacks, have been resurfaced with a waterproof traffic deck, and reportedly do not leak.

4. Interior Construction and Finishes

Lobby Areas — The lobby is the spacious full size of the 207' 2" square floor plate with 6-story high exterior glazed wall and architectural-shaped ceilings visible through the large curved atrium-type openings in the Plaza Level mezzanine 16' above the lobby. The center portion of the lobby contains the rectangular core (87' x 135') which is dedicated to the multiple banks of elevators. Glass paneled railings and security turnstiles with encoded card readers control access to the core elevator system.

The lobby has granite paneled floors with recessed carpeting, 6-story high marble core walls and pilasters with polished stainless steel reflective panels, and marble-faced exterior columns with glass vision lites. Elevator hoistway doors and trim are polished stainless steel. The lobby ceiling is suspended wire lath and plaster, with abutting 15' x 29' rectangular-shaped, concave panels, with ceiling mounted decorative crystal lens lighting fixtures in each panel. The panels are separated by 7 1/2" plaster trough borders. The ceiling is suspended 9' below the 7th floor, and has catwalks for access. The light bulbs used to be changed from above the hung ceiling, but now are changed by lift.

There is a marble-faced visitors counter along the west wall of the lobby, with recessed carpet flooring. A plan is currently in progress for replacement of this carpet and the carpet in the mezzanine of the lobby to meet the test requirements prescribed by the NYC Code. The fire command station is also in the lobby.

The north end of the lobby is accessed from the mall concourse, through 14 polished stainless steel-framed, glazed revolving doors with fixed glazed transoms above that fit between the Tower's 10' o/c columns. There are also 2 sets of automatic sliding doors leading to the concourse. The rear of the lobby has a glazed vestibule system opening to Liberty Street with 2 revolving exterior vestibule doors and 3 pair of swing doors. This entrance also has a set of automatic doors for persons with disabilities.

The Plaza Level mezzanine above the lobby has a curved atrium type opening on each side of the long dimension (N-S) of the core, extending the full length of the core and 2/3s the 60' wide span on each side of the core. The floors of the Plaza Level mezzanine are granite pavers with recessed carpets and the walls are marble.

The Plaza Level mezzanine is accessed from the plaza on the north face through 2 pairs of revolving doors fitting between the building's 10' o/c aluminum-clad columns. There are 2 pairs of swing doors also.

There is a pair of escalators that lead from the lobby to the Plaza Level Mezzanine.

Sky Lobbies

The middle and upper zone elevator systems are served by express elevators running from the main lobby to the sky lobbies at the 44th and 78th stories, where transfers to local service occurs. These lobbies are finished with granite bordered carpeted floors, verde marble walls, and arched plaster ceilings with chandeliers. Each sky lobby has a pair of escalators leading to the floor above and a pair leading to the floor below.

Core Corridors

The 87' wide x 135' long central core below the 44th floor sky lobby contains the 4 banks of 6 passenger elevators, low-rise express elevators, all freight elevators, 3 stair exits, 1 men's and 2 women's toilet rooms, air shafts, and utility closets. Above the 47th floor the core shrinks due to the elimination of the low-rise express elevators. Above the 81st floor, the core shrinks again due to the elimination of the high-rise elevators.

Each floor has a "T"-shaped corridor, which accesses 1 bank of 6 passenger elevators, 3 freight elevators (2 freight in upper zone), 3 stair exits and the toilet and utility rooms. Multi-tenanted corridor finishes are carpet, rubber base, painted walls, and suspended acoustic tile ceilings. Full floor tenants have individualized good grade elevator lobby finishes and corridor finishes. Some single-tenanted floors have elevator vestibule access to exits restricted by locked office doors which reportedly operate on a fail safe fire alarm door release system.

Tenant Offices

The tenant finishes are typically carpeted floors, vinyl base, painted walls, and suspended lay-in acoustic ceilings with recessed fluorescent fixtures. Some tenants have higher quality finishes.

Rest Rooms

There is typically 1 men's toilet room and 2 women's toilet room on each office floor, depending on the elevator shaft layout at a particular story. The rest rooms have ceramic tile floors, base, and walls, and lay-in suspended acoustic ceilings with downlights. Toilet partitions are ceiling-mounted painted steel. Most toilet rooms observed have the original ceramic tile finishes.

Exits

There are 3 interior exit stairs that serve all office floors. Stairs have painted concrete floors (with photo-luminescent paint directional stripes), painted steel stringer stairs with concrete-filled steel pan treads and intermediate level platforms, painted walls, and painted ceilings. Doors are locked from the stair shaft side, with reentry at every 4th story. One stair exits into the lobby which has egress to Liberty Street and the 2 other stairs exit into the Plaza Level mezzanine which has egress to the exterior plaza through swing doors on 3 sides of the building.

Sound Insulation

Carpets and suspended acoustic ceilings help to control noise transmission within the building.

Doors

Stair exit doors are self-closing hollow metal fire-rated.

Other

The B-1 level is used mainly for moving freight from the loading docks into the core elevator areas for dispersal throughout the building. It is a raw space with painted floors and walls, and bare ceilings with exposed mechanical services.

The B-2 to B-4 areas are used for construction and building maintenance offices, tenant storage, lockers and storage. Finishes are VCT floors, painted block walls, and suspended ceilings.

Level B-5 and B-6 house the mechanical equipment for the lower section of the building and the PATH ROW. Finishes are painted floors, walls, and bare concrete ceilings.

The Observation Deck occupying the 107th story, and its rooftop walkway provides spectacular views of New York City and its harbor, including overlooking the Statue of Liberty. This facility has a cafeteria, theater, and gift shop. Rest rooms are ADA compliant.

Freight elevator vestibules have VCT floors, rubber base, painted walls, and suspended ceilings.

Condition

Multi-tenant floor common area finishes are typically average quality and are adequately maintained. Corridor carpets are reportedly 2 years old. Elevator vestibules are good durable quality. Most corridors have original concealed spline acoustic ceiling tiles and many are displaying age- and usage-related wear, and replacement should be anticipated. Most toilet rooms are original durable finishes, with localized repairs for cracked tile or damaged tile required, as ordinary maintenance. A capital program was initiated to upgrade multi-tenanted corridors and toilet rooms. Approximately 6 floors have been completed.

Ceramic tile base and wall tile in some toilet rooms was observed to be damaged or cracked, and should be repaired as part of ordinary maintenance.

The 3 stair exit shafts typically display age- and usage-related wear and floors should be repainted. The nosings on Stair B (wide stair) are bent outward in isolated locations and require repair.

Tank room on floor 110 and MER on floor B-6 require floor repainting, which is planned to be done under the PA's Spit and Polish Program.

Lobby and sky lobby finishes are good quality. SIII I-24 (Data Room List), dated May 1, 1998, recommended additional hangers be installed in the suspended lobby ceiling, which were reportedly installed.

5. Vertical Transportation

Overview

There are 72 local stop passenger elevators and 19 express stop passenger elevators serving the office floors (9 - 106). There are 2 express elevators serving the 107th floor. There are 3 elevators (K cars) outside the building footprint that serve the B-1 to B-6 levels (Tower 2 and all subgrade spaces). The vertical transportation system is divided into 3 vertical zones serviced from the main lobby and the 2 sky lobbies, which are at the 44th and 78th floors. There are 8 express elevators traveling from the lobby to the 44th floor sky lobby and 11 express elevators traveling from the lobby to the 78th floor sky lobby. The main lobby and the sky lobbies each access 4 banks (A, B, C, D) of 6 cars which provide local service to portions of their respective zones. Each local bank of 6 elevators serves approximately 8 stories. The local service stacking design and the 2 sky lobbies minimize core size and keep floor areas relatively constant in size. Wind sway detectors, located on the 108th floor, automatically activate controllers to decrease elevator speeds during high wind sway conditions.

There are 8 service elevators serving the building.

There is one set of escalators serving the Lobby Level to the Plaza Level. There are 2 pair of escalators on each sky lobby floor, 1 set serving the floor below and 1 set serving the floor above the sky lobby. There are escalators from the 107th floor observation to the rooftop observation platform (one set extends from 107 to 110, and one set extends from 110 to the platform above roof level).

Cabs

Local service passenger cabs have carpeted floors, porcelain enamel wall panels with a narrow band of exposed marble at rail height, brushed stainless steel front panels, and brushed stainless steel center-opening single-speed elevator doors. The cabs have been updated to ADA compliance.

Express service passenger cabs have carpeted floors, marble wall panels, brushed stainless steel front panels, and brushed stainless steel center-opening double speed elevator doors. The mid-rise car controls have been updated to ADA compliance. Two upper zone car controls (18 and 19) have not been updated.

Inspections

The 5-year test tags are current.

Condition

A representative sampling was observed

The elevators and escalators appear adequately designed and are maintained under service contract with Ace Elevator Company. The PA performs maintenance Quality Assurance inspections.

Approximately 45% of the original elevator equipment has been modernized with another 5% in progress. Modernization of the balance is either ongoing or planned for prior to the 2nd quarter of 2004. Escalators have been modernized with start/stop switches, comb plate switches, demarcation lights, caution signs, controlled descent devices, and remote monitoring systems.

See Attachment 6 prepared by BOCA Elevator Consultants for the detailed elevator system report.

6. HVAC

Overall Systems

Heating and cooling for the building are provided by central station air handling units (AHUs) and perimeter induction units (PIUs) all utilizing pneumatic controls.

Heat

Medium pressure steam, supplied from the central steam station, goes through pressure reducing stations located in the 108th, 75th, 41st, and 7th floors, and B-6 Level mechanical equipment rooms (MERs). The low-pressure steam is piped to coils in AHUs, which supply interior spaces and PIUs on the floors.

Low-pressure steam is also piped to shell and tube heat exchangers in all MERs to produce secondary heating hot water, which is pumped to coils in the PIUs.

Additional heat is supplied by steam unit heaters located in mechanical spaces.

Heat Exchangers

Four shell and tube units for the condenser water system
Two plate and frame units for the condenser water system

Twenty-six shell and tube units for the secondary heating hot water/chilled water system

Air Conditioning

Chilled water from the central plant is supplied to coils in the AHUs and secondary chilled water is supplied to the PIUs. Each PIU has one coil, which is used for both heating hot water and chilled water.

A looped condenser water system is available for tenants' supplementary water-cooled air conditioning units.

Pumps

Four 1,400-gpm, 150 hp condenser water pumps
Two 600-gpm, 40 hp condenser water pumps

For Floors 9 - 24:

Four 40-hp, 890 gpm secondary water pumps, 2 standby

For Floors 25 - 58:

Two 40-hp, 580 gpm secondary water pumps, 1 standby
Four 40-hp, 745 gpm secondary water pumps, 2 standby
Two 40-hp, 990 gpm secondary water pumps, 1 standby

For Floors 59 - 74:

Two 40-hp, 580 gpm secondary water pumps, 1 standby
Four 40-hp, 745 gpm secondary water pumps, 2 standby
Two 40-hp, 990 gpm secondary water pumps, 1 standby

For Floors 92 - 105

Two 40-hp, 580 gpm secondary water pumps, 1 standby
Two 40-hp, 745 gpm secondary water pumps, 1 standby

For Floors 106 - 107:

Two 7.5-hp, 245 gpm secondary water pumps, 1 standby

Duplex steam condensate pumps

Air Handling Units

There are 7 AHUs located in the B-6 Level MER, rated at 8,000 to 28,000 cfm with 15 hp to 30 hp motors, that supply the loading dock, garage, and subgrade levels.

Fourteen central AHUs, located in the 7th floor MER, rated from 7,000 to 68,000 cfm with 15 hp to 100 hp motors, supply conditioned air to interior spaces and the PIUs.

Sixteen central AHUs, located in the 41st floor MER, rated from 6,000 to 95,000 cfm with 10 hp to 125 hp motors, supply conditioned air to interior spaces and the PIUs.

Sixteen central AHUs, located in the 75th floor MER, rated from 10,000 to 98,000 cfm with 10 hp to 150 hp motors, supply conditioned air to interior spaces and the PIUs.

Eleven central AHUs, located in the 108th floor MER, rated from 14,000 to 91,000 cfm with 10 hp to 150 hp motors, supply conditioned air to interior spaces and the PIUs.

Fans

Toilet, AHU return air, kitchen, and mechanical room exhaust fans are installed.

Condition

The mechanical systems are adequately designed, using brand-name equipment, which provides adequate cooling for the office areas. To allow for the expanded substations in the 75th floor MER, 2 AHUs were removed and new AHUs were installed. The original freeze protection system for the AHUs and reheat system for the heating hot water system have been abandoned in place, and consideration should be given to removal of the equipment for these systems. A new freeze protection system will be installed in all of the MERs over the next 5 years. The equipment has been well maintained, some nearly all equipment is original (28 years old), and has or will exceed its published service life over the next 10 years, and replacement should be anticipated. A recent capital program to update the HVAC air-handling equipment has effectively increased the anticipated service life of the equipment. Equipment or component maintenance and repair is performed as part of the ABM service contract.

7. Plumbing

Storm and Sanitary Sewers

Roof storm water is collected by roof drains and conveyed by internal leaders to the building's storm sewer.

Sanitary waste flows by gravity to the building's sewer.

Water Service

Metered city water, with a backflow preventer, enters a pump room on the B-1 Level and goes to Pump Station (PS) 1 which serves the B-1 Level up to the 41st floor. On the 7th floor MER, the water goes through a pressure reducing station and is supplied up to the 24th floor. Floors 25 - 41 are fed directly by PS1. On the 41st floor MER, the water goes to PS2 which supplies Floors 41 to 75, and a pressure reducing station before going to Floors 41- 58. Floors 59 - 75 are fed directly by PS2. PS3, located in the 75th floor MER, supplies Floors 75 - 108. In the 108th floor MER, the water goes through a pressure reducing station and is supplied to Floors 75 - 92. Floors 93 - 108 are fed directly by PS3.

Water Pipe Material

Copper supply piping was observed.

Domestic Water Heaters

Domestic hot water is provided by steam/water pre-heat tanks, steam/hot water heaters, and electric water heaters located in the 7th, 41st, 75th, and 108th floor MERs

Pumps

One 60-hp, 292 gpm domestic water pump on the B-1 Level supplying the 41st floor MER

Three 100-hp, 530 gpm domestic water pumps on the B-1 Level supplying the 41st floor MER

One 40-hp, 239 gpm domestic water pump in the 41st floor MER supplying the 75th floor MER

Three 75-hp, 477 gpm domestic water pumps in the 41st floor MER supplying the 75th floor MER

One 40-hp, 239 gpm domestic water pump in the 75th floor MER supplying the 108th floor MER

Three 75-hp, 424 gpm domestic water pumps in the 75th floor MER supplying the 108th floor MER

Ten 1.5 hp circulating pumps are installed for the water heaters.

Toilet Rooms

There are 2 sets of women's and 1 men's toilet rooms on each typical office floor.

Condition

The plumbing systems appear to be in generally good condition, and are reportedly functioning satisfactorily. There have recently been problems with the failure of water hammer arrestors and leaks (see the Executive Summary). Although in operation, replacement of pumps, and water heaters should be anticipated over the next 10 years. Equipment or component maintenance and repair is performed as part of the ABM service contract.

8. Electrical

Main Service

The Primary Distribution Center (PDC) on the B-3 Level supplies 13.8 kV primary electrical service to 10 electrical sub-stations in 2 WTC. There is 1 substation on the B-1 Level, 2 substations, on the 7th, 41st, 75th, and 108th floor MERs, and 1 tenant proprietary substation on the 43rd floor. Each substation, except the one on the 43rd floor, is served by four 13.8-kV high voltage feeders, and the 43rd floor substation is served by two 13.8-kV high voltage feeders.

The 13.8 kV is stepped down to 480/277 volts. The substations on the B-1 Level, 7th, 41st, and 108th floor each have 2 switchboards with 4,000-ampere main breakers. The substations on the 43rd and 75th floors each have 4 switchboards that are in a tie bus configuration. Normal power is distributed to the tenants through 120/208-volt and 277/480-volt bus ducts located in 2 electric closets on each floor. Two 277/480-volt tenant bus ducts are located in a third electric closer form the 54th to the 74th floors.

Capacity

An adequate 10 watts/sq. ft. is provided from the 58th floor through the 92nd floor. Six watts/sq. ft. is available in the remaining areas of this Tower.

Wiring

Copper and aluminum wiring, with mechanical connectors, was observed between disconnect switches on bus duct risers and power panels.

Emergency Power

Six generators, located in the central plant, supply emergency power for lighting, elevators, and the life safety system. Power is distributed throughout the Tower through one electric closet on each floor. Certain select feeders are backed up by the tertiary power substation originating from PSE&G via the PATH system. Tenant standby power is provided from a central plant located on the roof of 5 WTC. The power is distributed through a 13.8 kV feeder to 2 substations located in MERs on the 41st and 75th floor MERs.

Lighting

Recessed, surface- and wall-mounted, and suspended fluorescent fixtures, and wall-mounted incandescent fixtures provide interior building lighting.

Other

Four telephone/communication closets are located on each typical office floor.

A closed circuit television (CCTV) system is installed.

Condition

The electrical systems are functioning satisfactorily. The electrical system is infrared scanned on a regular basis.

9. Life Safety

Sprinklers

The office floors of the building have been retrofitted with sprinklers, except for electric and telephone closets, most toilet rooms, the main lobby, and the B-6 Level MER. A sprinkler riser control room is located on each floor, with branch lines for the floors sprinklers and flow and tamper switches.

Fire Standpipe

A standpipe riser, with a fire hose rack on each floor, is installed in each stairway.

Fire Pumps

A 100-hp, 1,500-gpm electric pump located on Level 294 supplies sprinklers on Levels B-1 and 310.

A 30-hp, 500-gpm electric pump in the 108th floor MER supplies sprinklers on Floors 99 and 110.

Standpipe/fire hose racks are supplied by 300-hp, 750-gpm electric fire pumps on Level 294 and in the 7th, 41st, and 75th floor MERs.

Tanks

5,000-gal. rectangular steel fire reserve tank, located on the 110th floor, for the standpipe risers

5,000-gal. rectangular steel fire reserve tank, located in the 75th and 41st floor MERs

10,000-gal. rectangular steel fire reserve tank, located on the 110th floor, for the sprinklers on Floors 33 - 108

Fire Alarm System

A Sieman's Cerebrus Pyrotronics MXL fire alarm system is installed with control and annunciator panels, manual pull stations, alarms, audio/visual alarms, strobe lights, flow and tamper switches, fire warden telephones, and smoke detectors.

Fire Extinguishers

Fire extinguisher cabinets are located in each stair on each floor and in the elevator machine rooms.

Emergency Lighting

Fluorescent fixtures, with battery back-up, are located in the stairs, and all elevators in the complex have 2-hour battery back-up lighting. Selected fixtures are connected to emergency circuits.

Exit Lighting

Illuminated exit signs are provided, which are connected to emergency circuits.

GFIs — Installed in some toilet rooms.

Condition — The life safety systems are typical for a Class "A" office building and meets the New York City Code. A new fire alarm system is currently being installed. Some of the toilet rooms have electrical outlets without ground fault interruption (GFI) protection, which is recommended.

10. Energy Conservation

General — The building was constructed with certain energy conserving features such as insulated walls and roofing, SCR drives on the elevators. The elevator relay controllers are being replaced with microprocessors. Most of the lighting fixtures use energy saving fluorescent lamps and electronic ballasts.

Energy Management — The building does not have an energy management system.

11. ADA Compliance

Overview — For the purpose of this report, a general review of the property has been conducted to determine basic compliance with Title III of the federally-enacted ADA, dated July 26, 1990. Under the ADA, buildings initially occupied after January 26, 1993 (or building areas altered after January 26, 1992), are required to comply with ADAAG. Projects, with areas of public accommodation, constructed prior to this date are required to comply forthwith, to the extent it is "readily achievable." Provisions in the Act require Owners of existing properties with public accommodations to identify barriers for physically disabled persons that exist on the site or in buildings. The barriers should be systematically removed according to a given set of priorities, the degree allowed by structural feasibility, and the financial resources available. The obligation to remove barriers is a continuing one.

The ADA sets forth "recommended priorities for public accommodations" to be accessible to the disabled. In general, the three priorities are as follows:

1. Access from public sidewalks, parking, or public transportation to a building entrance,
2. Access to any areas of goods and services that are made available to the public; and,
3. Access to rest room facilities.

During our tour of the project, we noted the following:

The building's primary entrance is from Liberty Street into the Tower lobby, and has automatic power-operated entrance doors. The Concourse entrance also has 2 sets of automatic doors. The path to the elevators is accessible.

The Plaza Level entrance has 2 sets of swing doors, without automatic door opening hardware. Provide door-opening hardware on 1 set of swing doors to make the entrance accessible. The elevators to the Observation Deck are accessible at this Level.

The banks of local and express elevators are equipped with car control panels that comply substantially with ADAAG. Upper Zone Express Elevator 16 is not equipped with complying car controls.

Approximately 25% of multi-tenanted toilet rooms have had upgrades for ADA requirements, but in most rooms observed, there were noncompliant items such as lack of full size ADA toilet stalls, and ADA compliant urinals. ADA compliance on most full tenant floors is reportedly the responsibility of the tenant under terms of the lease.

12. Code Compliance

Applicable Code

1968 NYC Building Code as Administered by the Port Authority of New York and New Jersey

Building Construction Classification

Class1-B - noncombustible, fire-protected, retrofitted with sprinklers in accordance with Local Law 5/1973

Occupancy Type

Group E - Business

Violations Record

As stated in the Offering Memorandum, "The Port Authority is a municipal corporate instrumentality and political subdivision of the States of New York and New Jersey which provides transportation, terminal, and other facilities of commerce within the Port District. As such, in connection with the Transaction, the PA will continue to maintain exclusive jurisdiction with respect to certain administrative and governmental matters involving the Complex, including compliance with building, environmental, fire and health codes." The New York City Department of Buildings has indicated that they do not maintain any records of violations for this property. A request for a Property Profile Overview for this block and lot number yields no records. The Fire Department provides normal fire fighting and a life safety

service to the facility. A Memorandum of Understanding exists between the Port Authority and the Fire Department in which the Fire Department performs regular inspections and directly notifies the Port Authority Fire and Life Safety group of deficiencies to be corrected. Under a protocol with the New York City Fire Department, Port Authority Police personnel investigate certain fire alarms at the World Trade Center rather than transmitting such alarms to the New York City Fire Department.

Certificate of Occupancy

A Certificate of Occupancy has not been issued by the City of New York because property owned by the Port Authority is not subject to the Building Code of the City of New York. We have observed "Permits to Use or Occupy" issued by the Port Authority for specific work, notably the October 10, 1997, Permit issued following completion of repairs following the 1993 bombing, but the Port Authority did not routinely issue the equivalent of a Base Building Occupancy Certificate until January 1992. In addition, in December 1995, the Port Authority started an optional "Professional Self-Certification" program for alteration work by tenants. The PA has issued "Consent to Occupy" certificates for specific work under this program.

E. Recommendations

We have prepared a listing of items that will require action within the next 10-year period. Immediate expenditures indicate deficiencies which are in violation of codes, which pose a danger to public safety, or which, if left uncorrected, will lead to further deterioration of the property or significantly impact marketability or habitability. Recommended work, not required by agencies or codes, which, in our opinion, represents expenditures that should be made in the context of the prudent management of the property is also listed. These items should be undertaken on a priority basis. Items have been divided into 1- to 5-year and 6- to 10-year time frames.

	IMMEDIATE (0 - 1 YR.)	FUTURE (1 - 5 YRS.)	FUTURE (6- 10 YRS.)
General			
1. The net lessee must continue installation of the new fire alarm system and phased implementation of Local Law 5 and 16 requirements. It is reported that the FDNY has approved this approach.	*X*	*X*	*X*
Structure			
2. Structural Integrity Inspection (SII) reports have been performed on an ongoing basis by Leslie E Robertson Associates (LERA) and other engineering firms, on many of the structural components of all WTC buildings. Deficiencies typically noted are rusting conditions in the steel columns in the elevator shafts, missing fireproofing, and occasional floor coring damage. Reportedly, the deficiencies noted in the most recent reports (i.e., SII 73 Data Room List) are being corrected.	*X*	-	-

	IMMEDIATE (0 - 1 YR.)	FUTURE (1 - 5 YRS.)	FUTURE (6- 10 YRS.)
3. Visco-elastic dampers located at each floor joist at the connection to the perimeter columns dampen the building's sway motion. Sample dampers are tested every 5 years, the most recent in 1996 (SII 51, Data Room List). Retesting is due this year. Availability of replacement dampers must be ascertained. Responsibility for ultimately replacing these units should be clarified. Approximately 2 dozen spares are available.	X	-	-
4. LERA strongly recommends (SII 72, Data Room List) that the analysis of wind acceleration measurements be continued, to monitor the dynamic behavior of the structure. They note that the 30-year-old visco-elastic dampers on the floor open web trusses have a finite life and must be monitored.	X	X	X
Exterior			
5. Recent SII reports note that the window gasketing is starting to exhibit age-related deterioration. The need to implement a program of wet sealing the gaskets should be anticipated.	-	-	X
6. The clear lacquer-coated anodized aluminum column covers exhibit finish tinting variations between panels. This does not affect the physical performance of the column covers. Cleaning of the facade is recommended.	-	-	X

	IMMEDIATE (0 - 1 YR.)	FUTURE (1 - 5 YRS.)	FUTURE (6- 10 YRS.)
7. The 110th-story facade slopes inward, and extends above the roof level to form the roof parapet. The steel supports are rusting and repainting is required.	X	-	-
Roof			
8. There is ponding observed in some locations on the roof in the window-washing rig track area requiring concrete (or asphalt) build-up fill to correct.	X	-	-
9. The concrete overlay is displaying age- and exposure-related deterioration, and a top coating is anticipated within the next 5 years.	-	X	-
10. The rooftop rails for the window-washing rig, the metal fencing, and the exterior metal stair components are rusting and require repainting.	X	-	-
Interiors			
11. The floors of the 3 stair exit shafts typically display age- and usage-related wear and require repainting	X	X	-
12. The steel pan stair tread nosings on Stair B (wide stair) are bent outward in isolated locations and require repair.	X	-	-

	IMMEDIATE (0 - 1 YR.)	FUTURE (1 - 5 YRS.)	FUTURE (6- 10 YRS.)
13. Tank (110th) floor and mechanical equipment floor, B-6, require floor repainting, which is planned to be done under the PA's Spit and Polish Program.	X	-	-
14. Ceramic tile base and wall tile in some toilet rooms was observed to be damaged or cracked, and should be repaired as part of ordinary maintenance.	-	-	-
15. Lobby and sky lobby finishes are good quality. SSI 24 (Data Room List), dated May 1, 1998, recommended additional hangers be installed in the suspended lobby ceiling, which were reportedly installed.	-	-	-
16. Replacement of 12" x 12" concealed spline corridor ceilings on multi-tenant floors is anticipated. A capital program was initiated to upgrade multi-tenanted corridors and toilet rooms. Approximately 6 floors have been completed.	-	X	-
Vertical Transportation			
17. Approximately 45% of the original elevator equipment has been modernized with another 5% in progress. The remaining equipment has exceeded its functional useful life expectancy and continuing modernization is planned to be complete by the 2nd quarter of 2004.	-	X	-

		IMMEDIATE (0 - 1 YR.)	FUTURE (1 - 5 YRS.)	FUTURE (6- 10 YRS.)
HVAC				
18.	Considering the age (28 years) of most of the mechanical equipment, ongoing phased replacement of components should be expected to continue over the next 10 years. This required maintenance is currently accomplished under the terms of the service contract with ABM.	*X*	*X*	*X*
19.	Consideration should be given to removal of the pumps and bases, piping, heat exchangers, and valves related to the chilled water freeze protection and hot water reheat systems no longer in use.	-	*X*	-
20.	HVAC distribution system rehabilitation and capacity upgrades are budgeted over the next 5 years.	-	*X*	-
21.	Installation of a new freeze protection system is budgeted over the next 5 years.	-	*X*	-
22.	Upgrades to the HVAC controls and smoke management systems is budgeted over the next 5 years.	-	*X*	-

	IMMEDIATE (0 - 1 YR.)	FUTURE (1 - 5 YRS.)	FUTURE (6- 10 YRS.)
Plumbing			
23. Replacement or refurbishment of the various pumps and water heaters should be anticipated over the next 10 years as the equipment reaches the limits of service life. This required maintenance is currently accomplished under the terms of the service contract with ABM.	X	X	X
24. Phased replacement of water hammer arrestors is necessary.	X	X	X
Life Safety			
25. Replace unprotected electrical outlets with GFI protected outlets in all toilet rooms.	X	-	-
26. Fire alarm system upgrades and office space security systems are budgeted over the next 2 years in PA and tenant areas.	X	X	-

ADA

During our tour of the project, we noted the following areas that do not appear to meet the requirements of ADAAG and suggest that these features be added when feasible or when areas are renovated.

1. Some (25% of the multi-tenanted floors) toilet rooms have had upgrades for ADA requirements, but in most rooms observed, there were noncompliant items such as lack of full size ADA toilet stalls, and ADA compliant urinals. ADA compliance on most full tenant floors is reportedly the responsibility of the tenant under terms of the lease.

2. One Upper Zone elevator (16) is not equipped with complying car controls.

F. Attachments

1. Photographs
2. Site Orientation Map (Reproduced with permission from J.P. Morgan Property Book)
3. Lobby Floor Plan (Reproduced with permission from J.P. Morgan Property Book)
4. Typical Floor Plan (Reproduced with permission from J.P. Morgan Property Book)
5. Stacking Plan (Reproduced with permission from J.P. Morgan Property Book)
6. BOCA Group International Vertical Transportation Study
7. Crandlemere and Associates Asbestos-Containing Materials Document Review and Evaluation
8. Crandlemere and Associates Roof-Mounted Transmission Devices Document Review and Evaluation
9. Heitmann & Associates Curtain Wall Evaluation

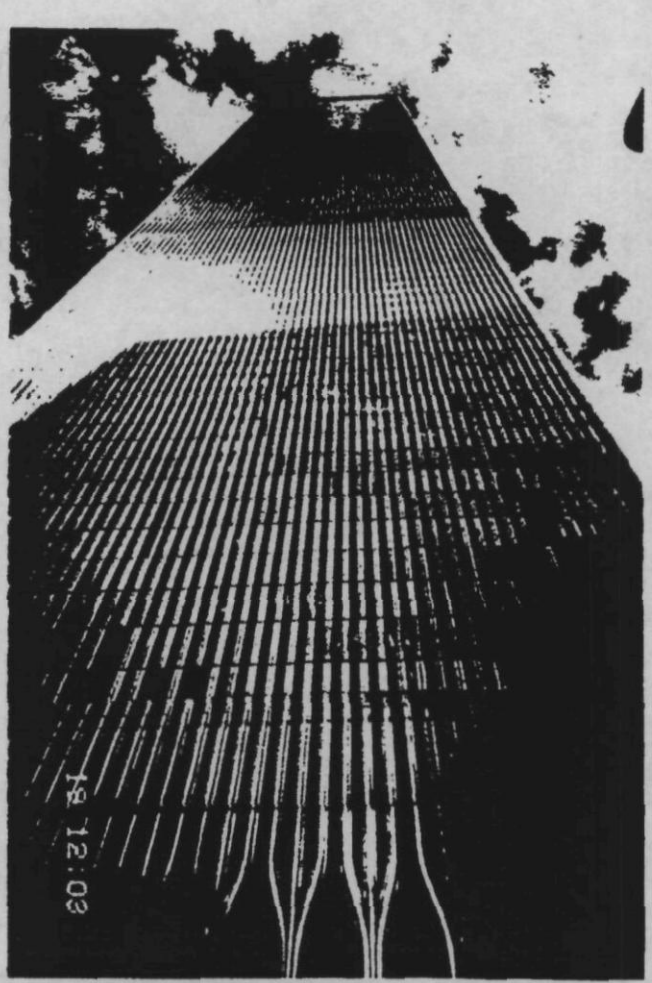
SECTION V – EXISTING PROPERTY DESCRIPTIONS & CONDITIONS

A. Overall Project

Building Type	Commercial Office Building
Built-Circa	1971
Certificate of Occupancy	A Certificate of Occupancy has not been issued by the City of New York because property owned by the Port Authority is not subject to the Building Code of the City of New York. We have observed "Permits to Use or Occupy" issued by the Port Authority for specific work, notably the October 10, 1997, Permit issued following completion of repairs following the 1993 bombing, but the Port Authority did not routinely issue the equivalent of a Base Building Occupancy Certificate until January 1997. In addition, in December 1995, the Port Authority (PA) started an optional "Self Certification" program for alteration work by tenants. The PA has issued "Consent to Occupy" for specific work under this program.
Story Height	12' 0" typical office story 14' 0" at sky lobbies 14' at 43rd and 16' at 67th floors 28' (2-story) at mechanical equipment rooms (MER)
Number of Stories	110 stories plus 6-subgrade levels
Building Height	The overall building height from lobby level to the roof level is reported at 1,368'.
Total Sq. Ft. (Bldg. Area)	42, 900 gsf (gross sq. ft.) footprint calculated 4,761,416 gsf (1968 REBNY) 4,468,634 gsf (as remeasured by REBNY 1987 Guideline 4,358,604 rsf May 31, 2000 (Rent Roll Sq. Ft.)

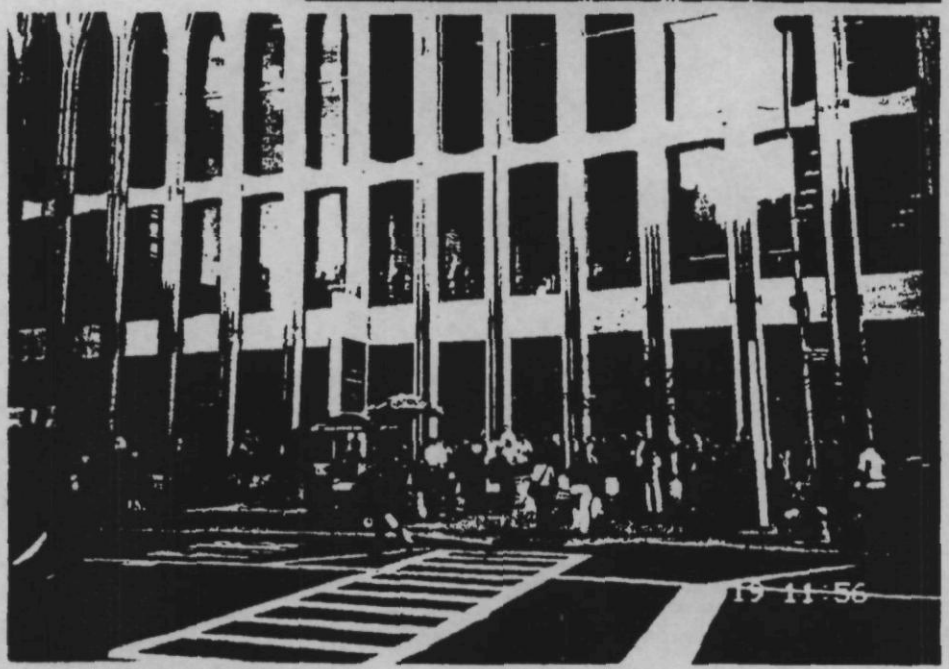
ATTACHMENT 1

Photographs



Photograph 1

Liberty Street elevation

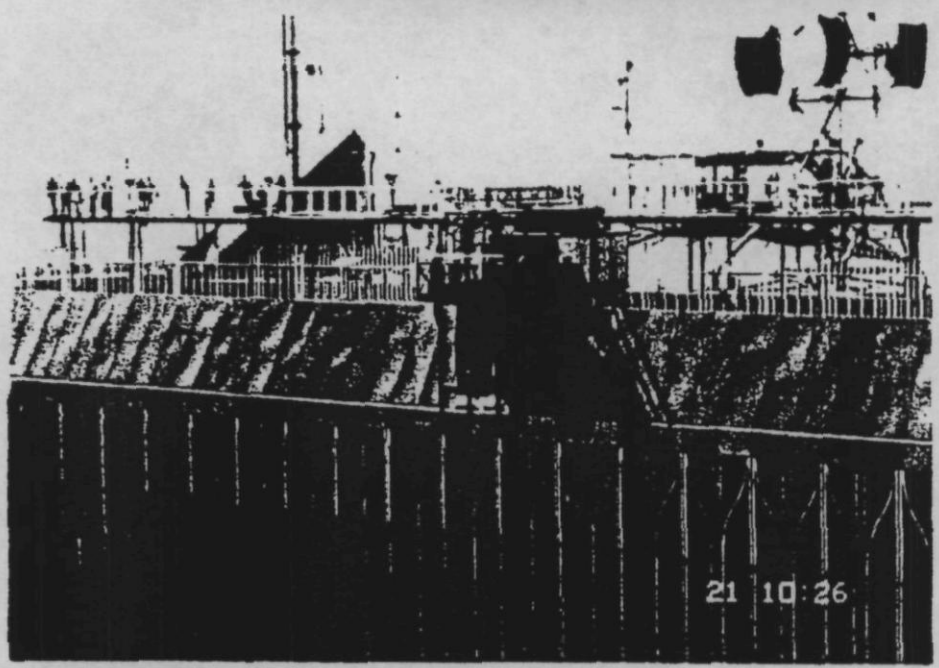


Photograph 2

Liberty Street entrance to Lobby

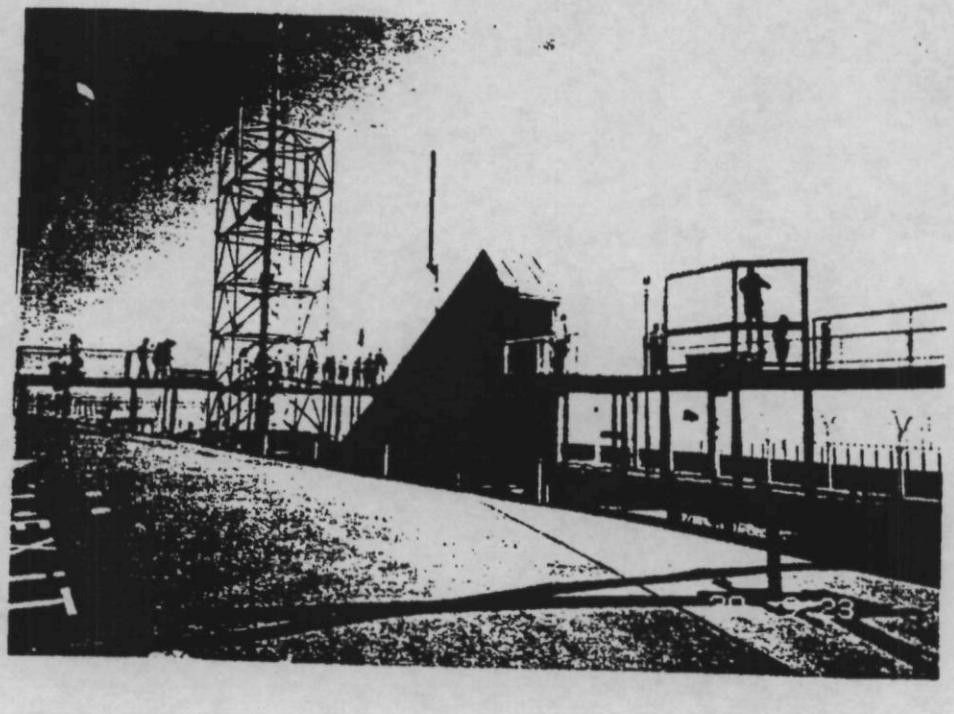
Photograph 3

Plaza elevation, Marriott hotel in background



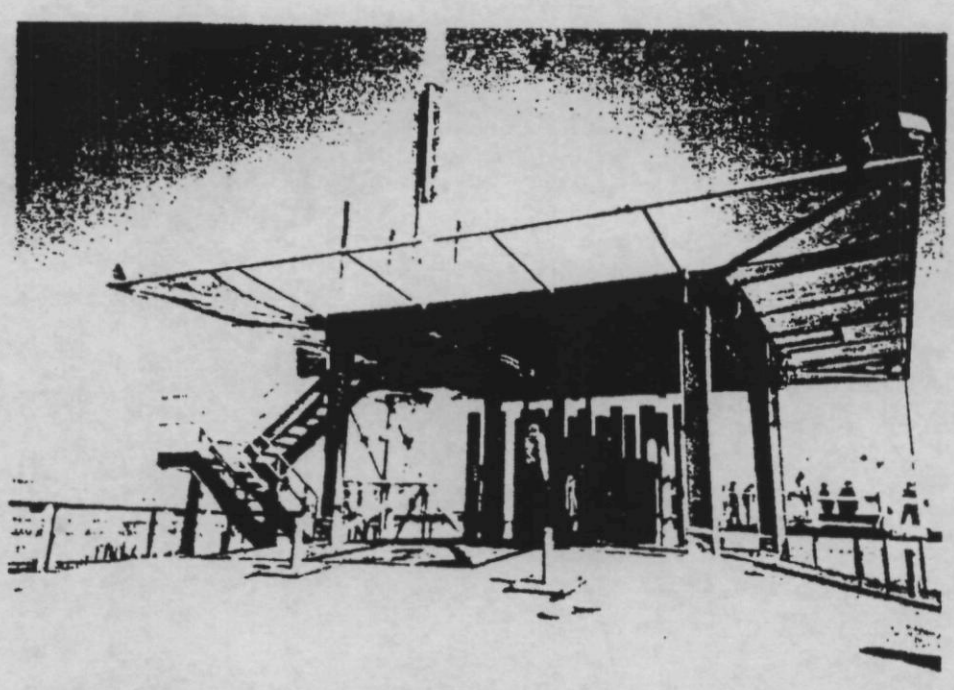
Photograph 4

Rooftop observation deck, window washing rig



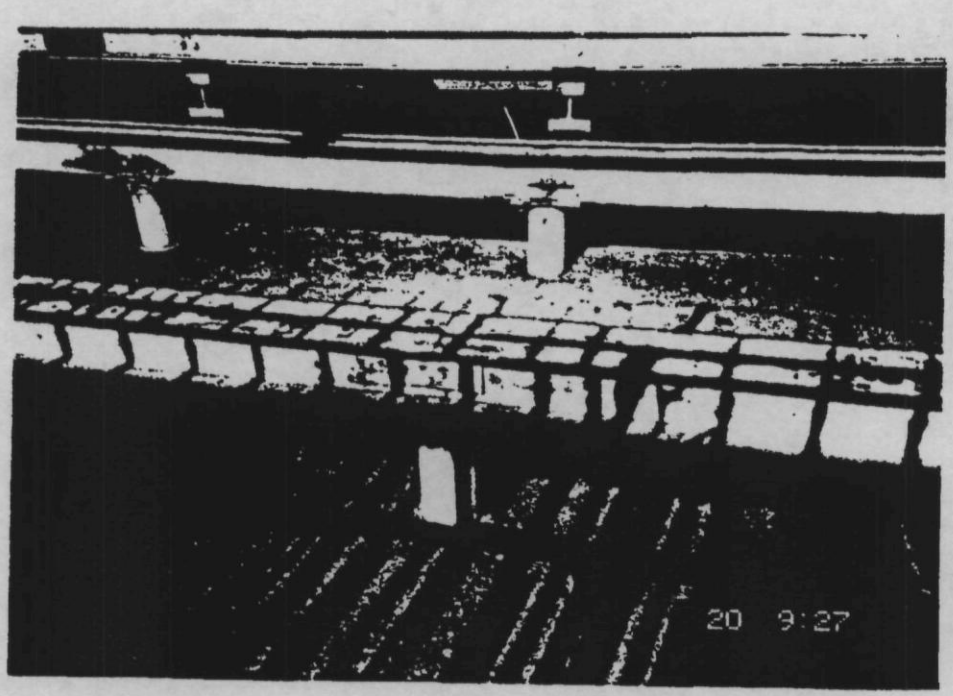
Photograph 5

Entrance to rooftop observation deck; note concrete covered roof



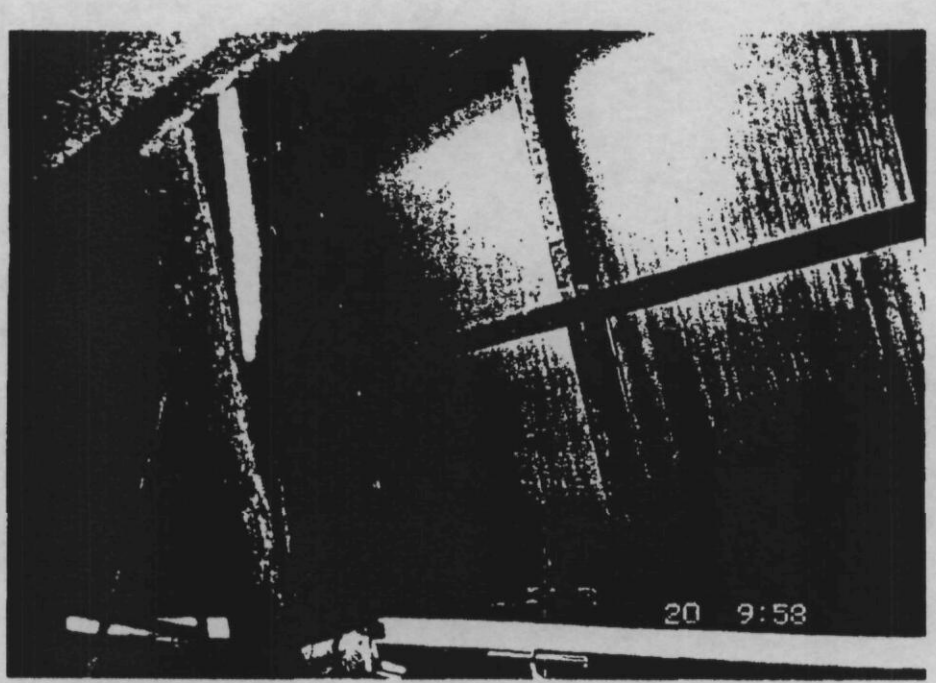
Photograph 6

Helicopter pad



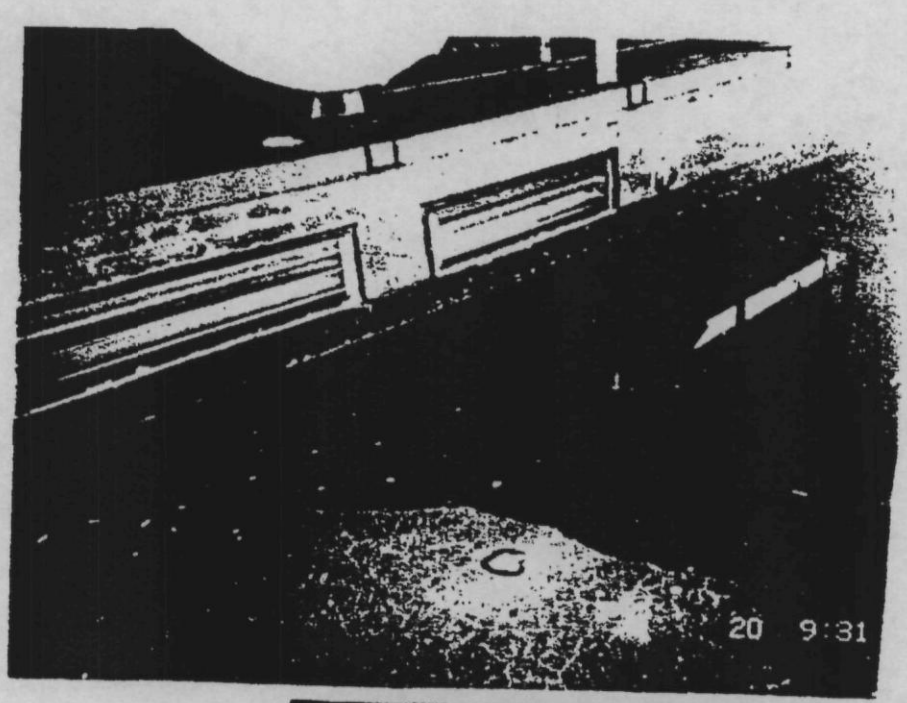
Photograph 7

Rusted window washing rig rails



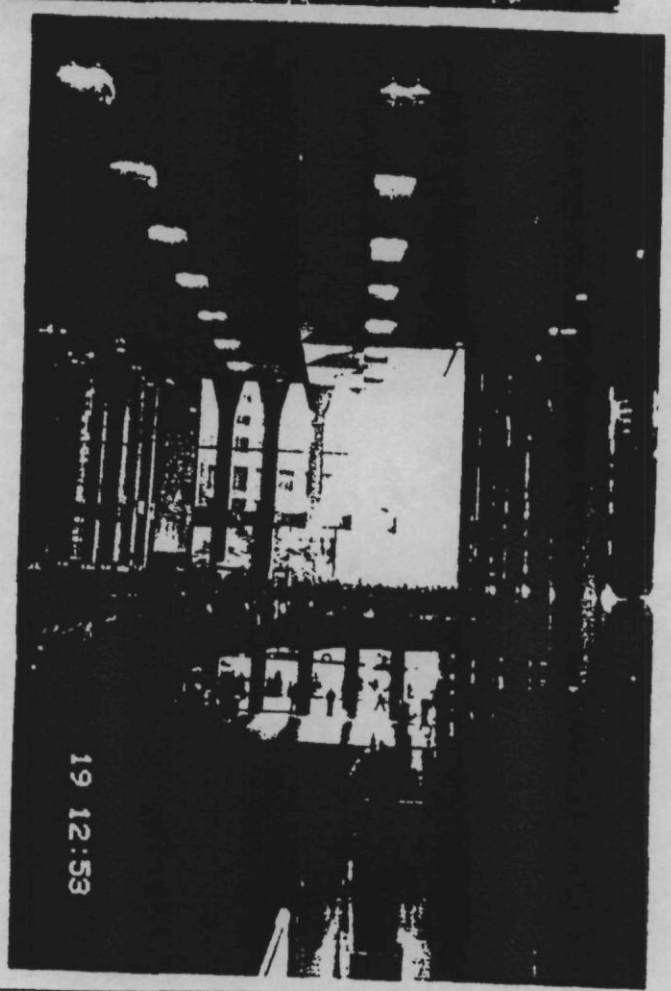
Photograph 8

Rusting purlins for exposed facade at 110-story and at roof



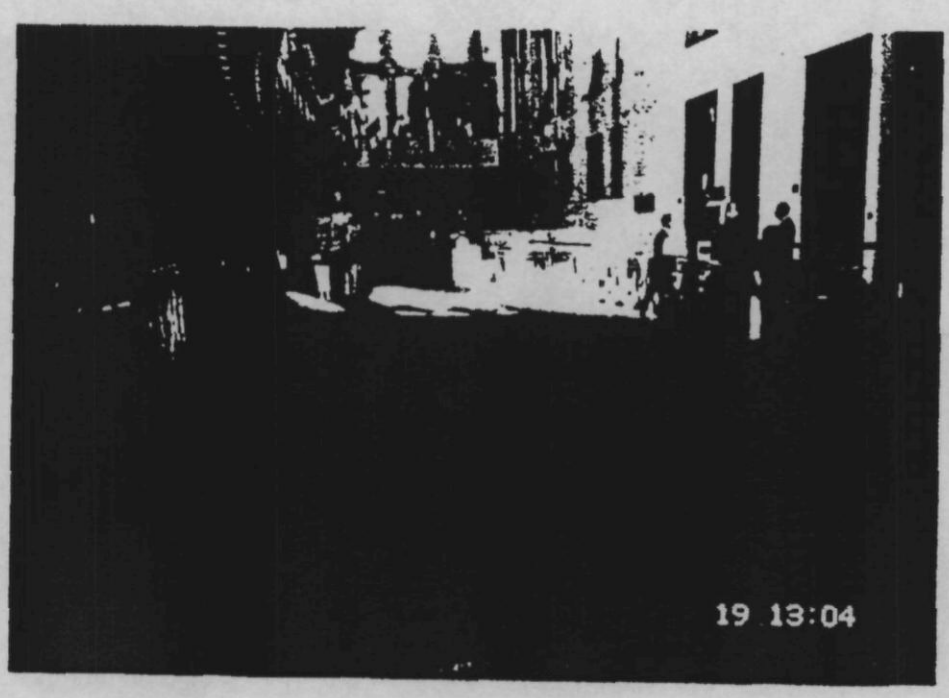
Photograph 9

Puddles at main roof indicate poor drainage



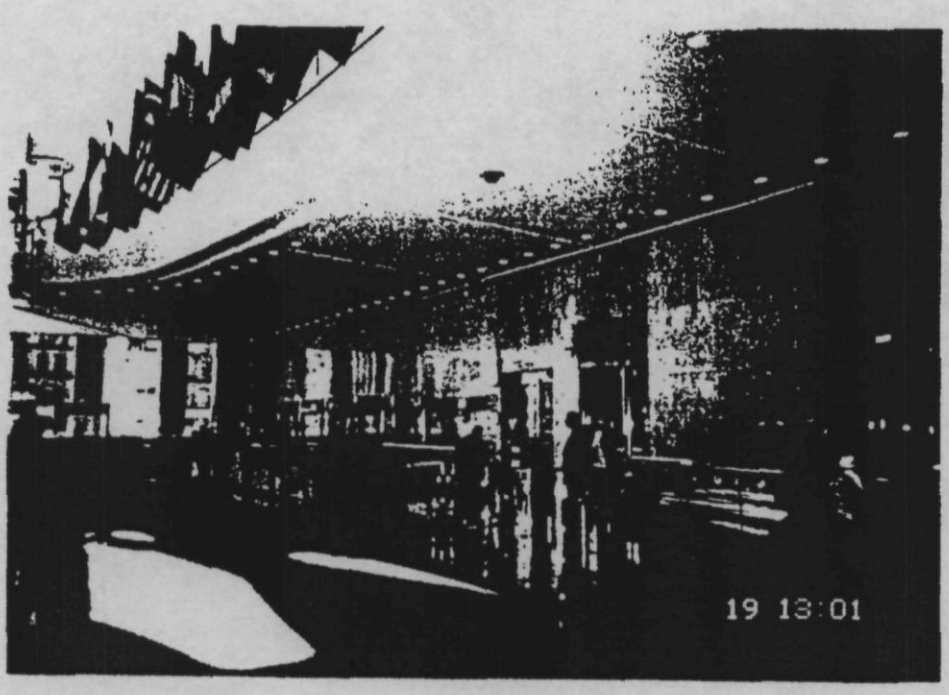
Photograph 10

Lobby and mezzanine



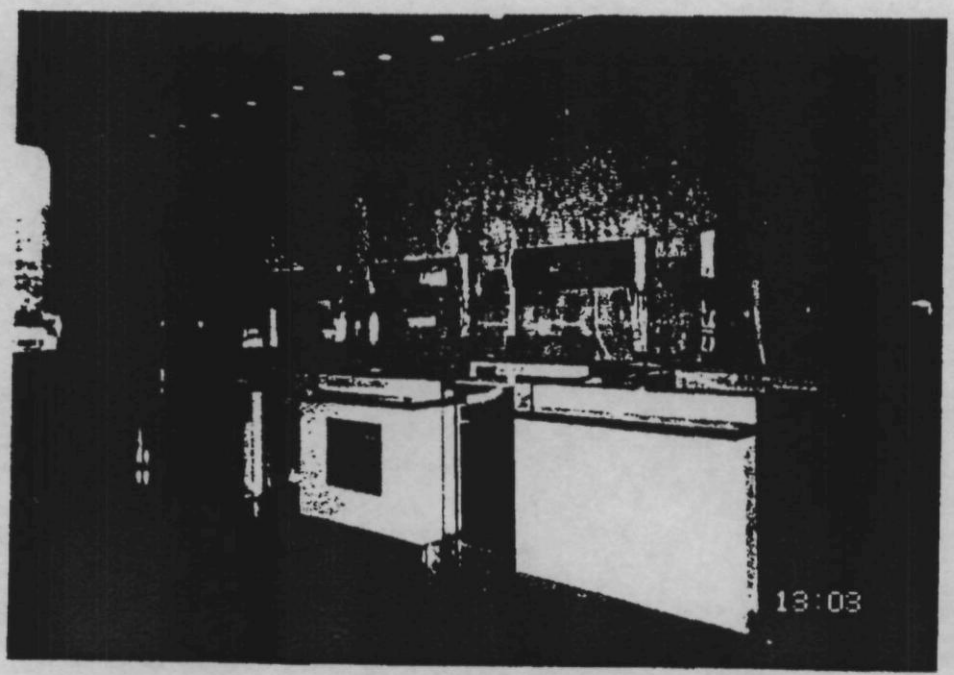
Photograph 11

Lobby - visitors desk on left, security gates to elevators on right



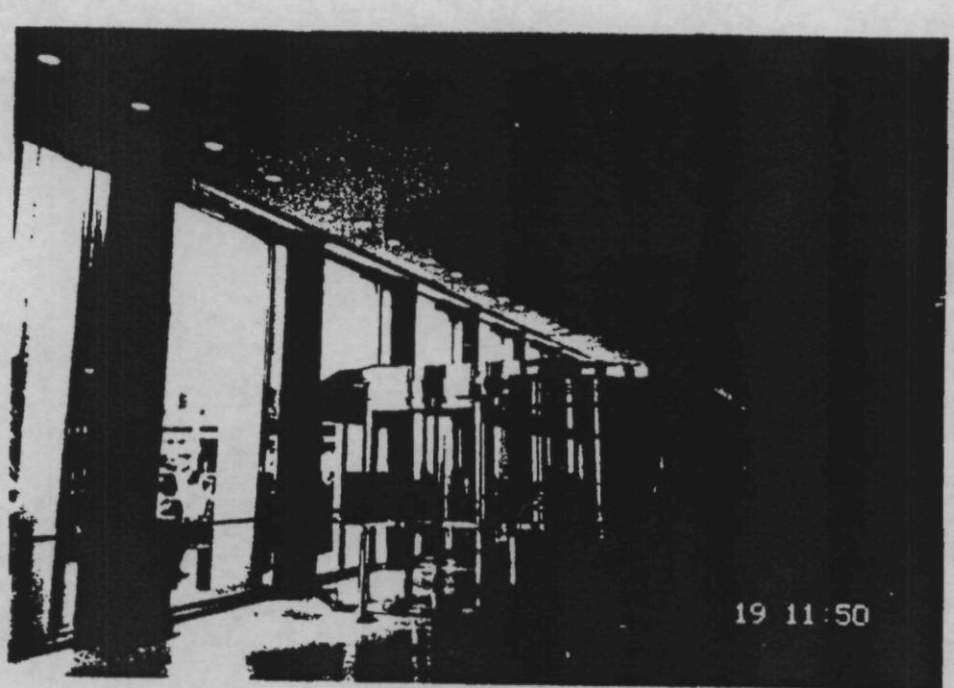
Photograph 12

Lobby, secured entrance to elevators to garage on right



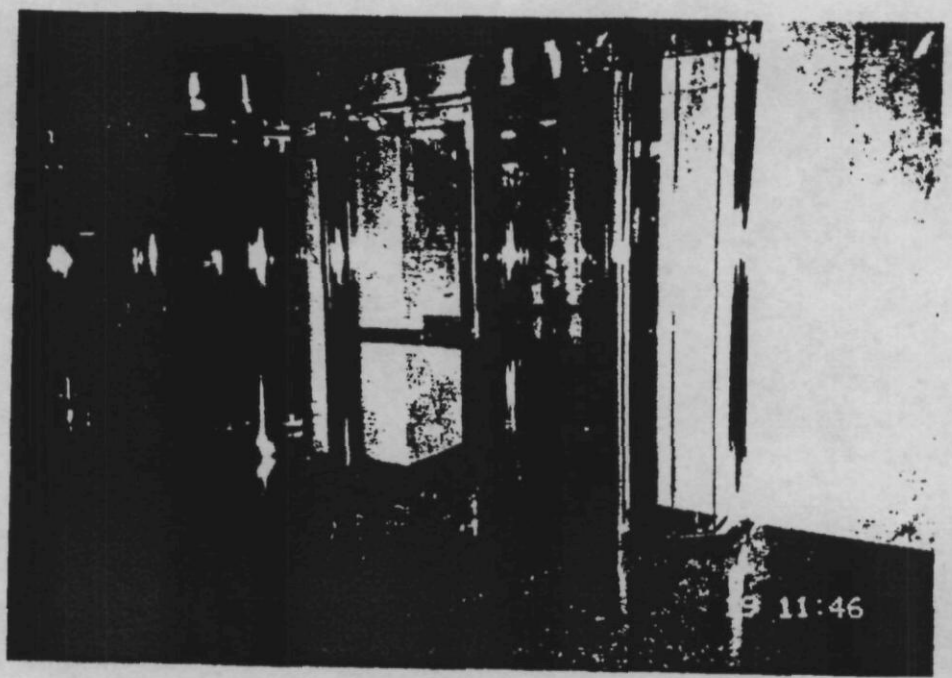
Photograph 13

Vacated desks in lobby



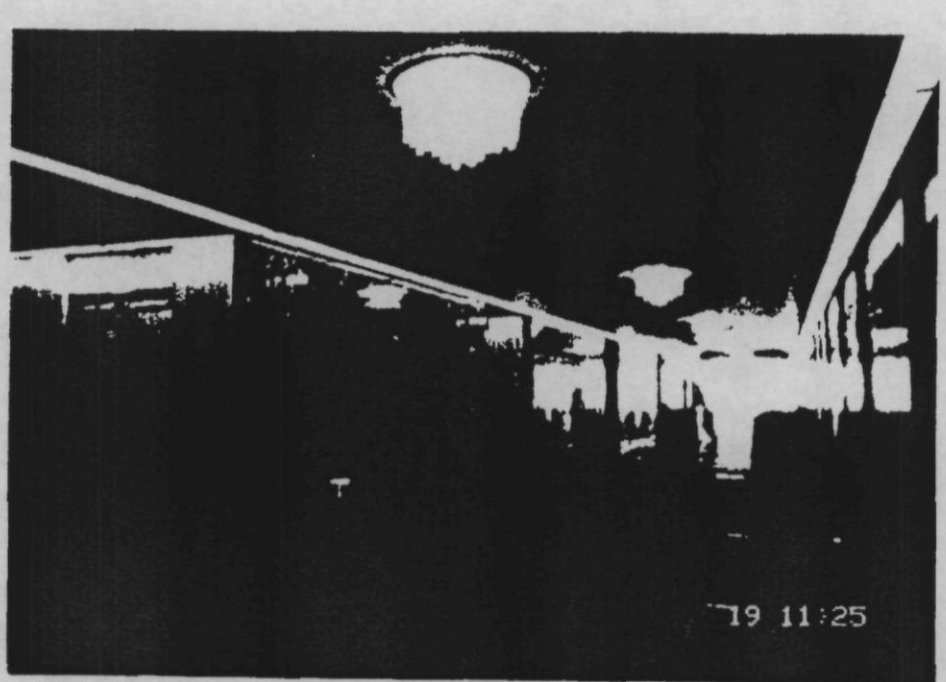
Photograph 14

Lobby and vestibule entrance from Liberty Street



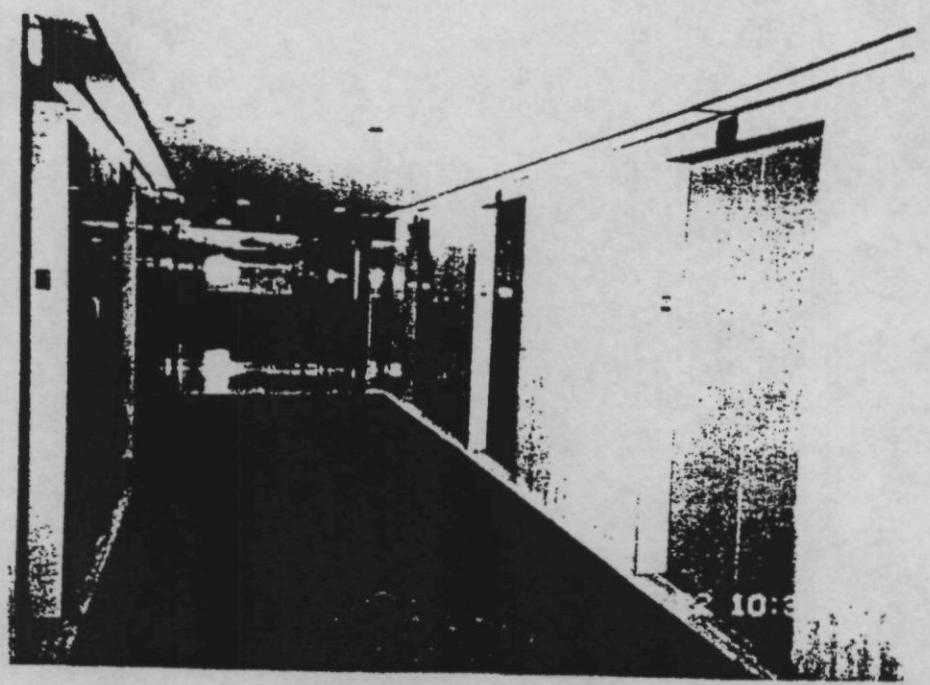
Photograph 15

ADA accessible entrance from mall



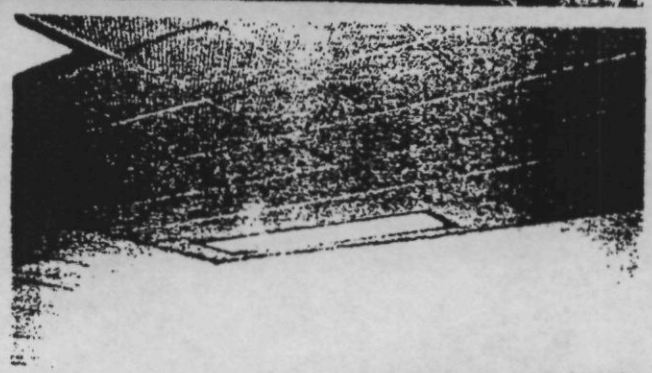
Photograph 16

Typical sky lobby



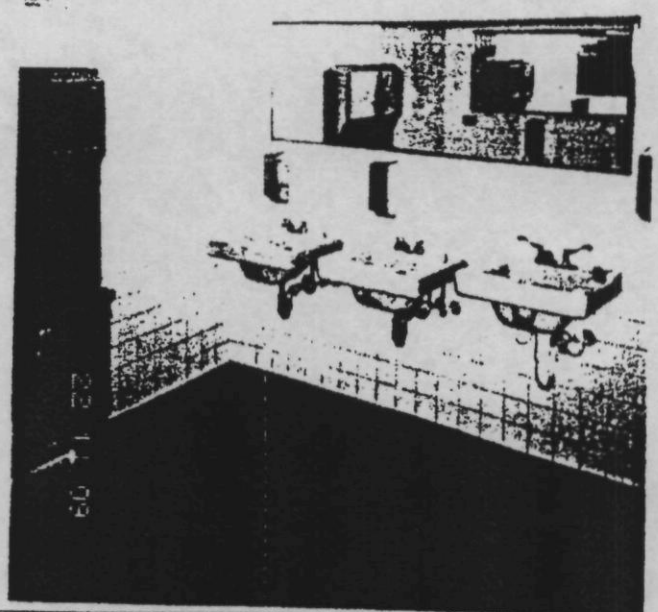
Photograph 17

Typical multi-tenant elevator vestibule



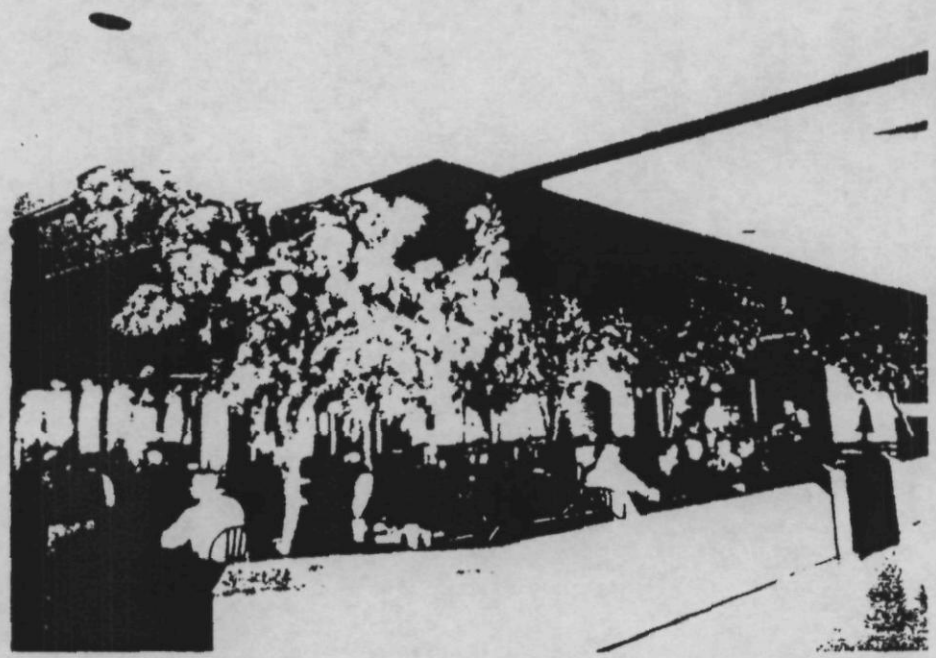
Photograph 18

Typical toilet room with original finishes



Photograph 19

Observation deck cafeteria

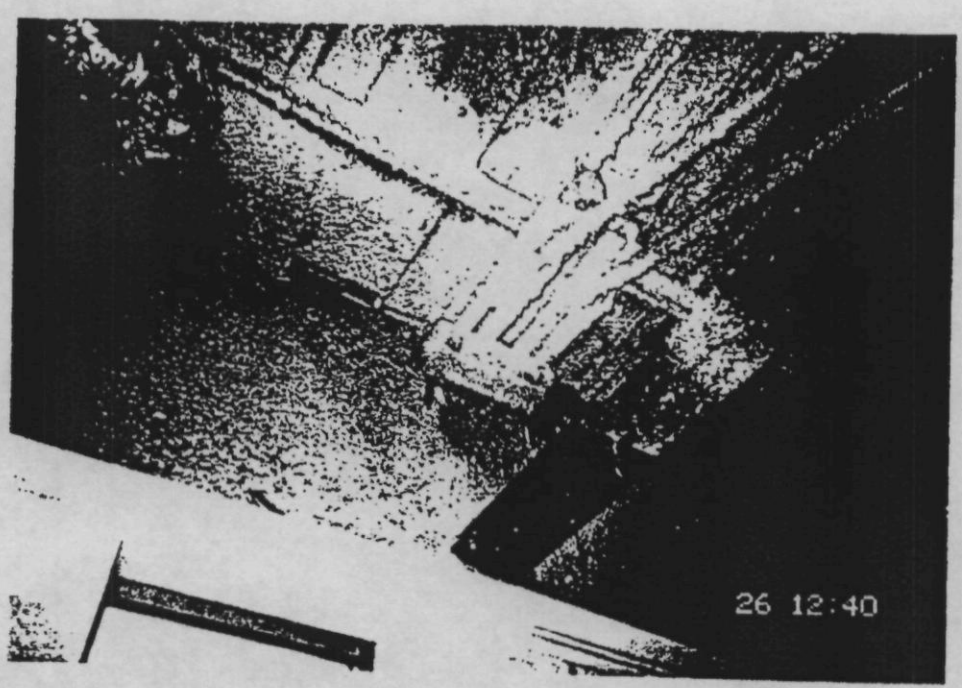


Photograph 20

Observation deck eating area

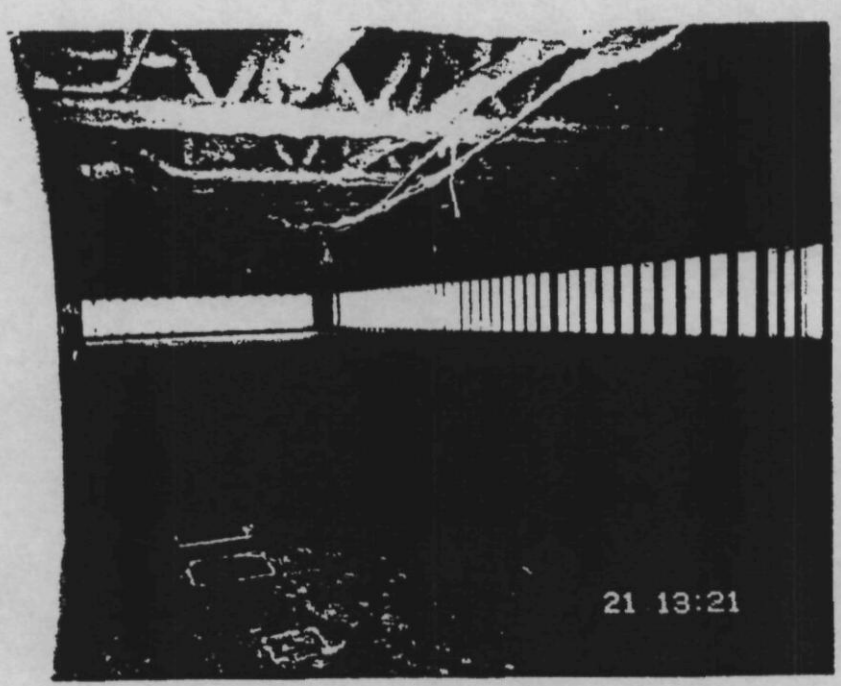
Photograph 21

Typical floor office interior



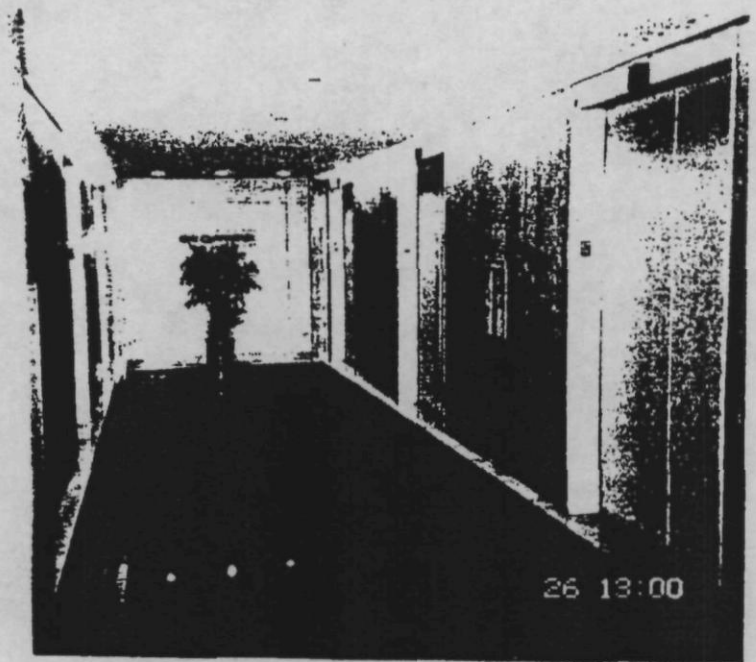
Photograph 22

Viscoelastic damper at each floor joist



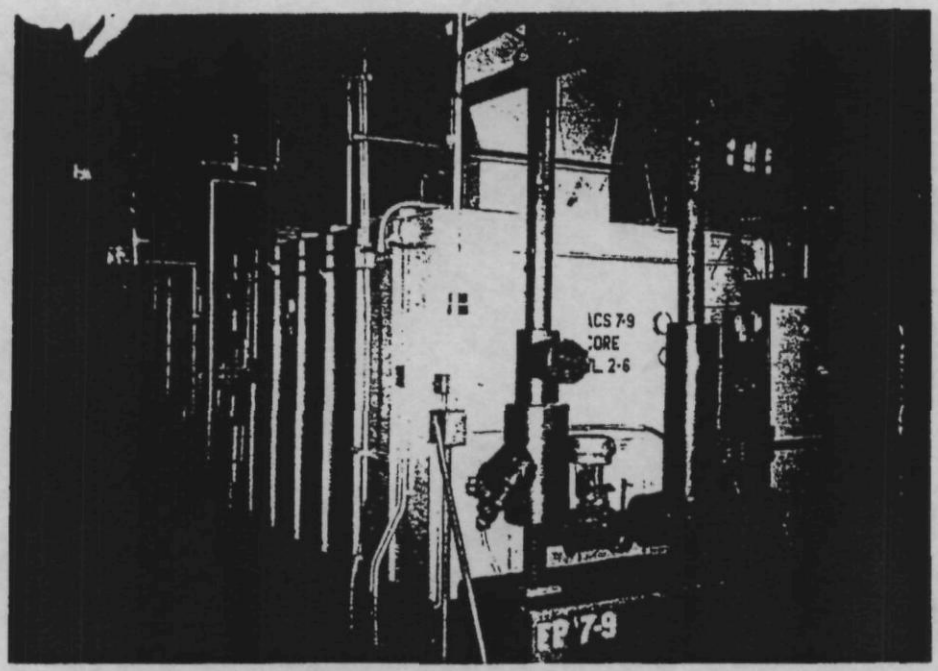
Photograph 23

Typical floor framing system after fireproofing respraying



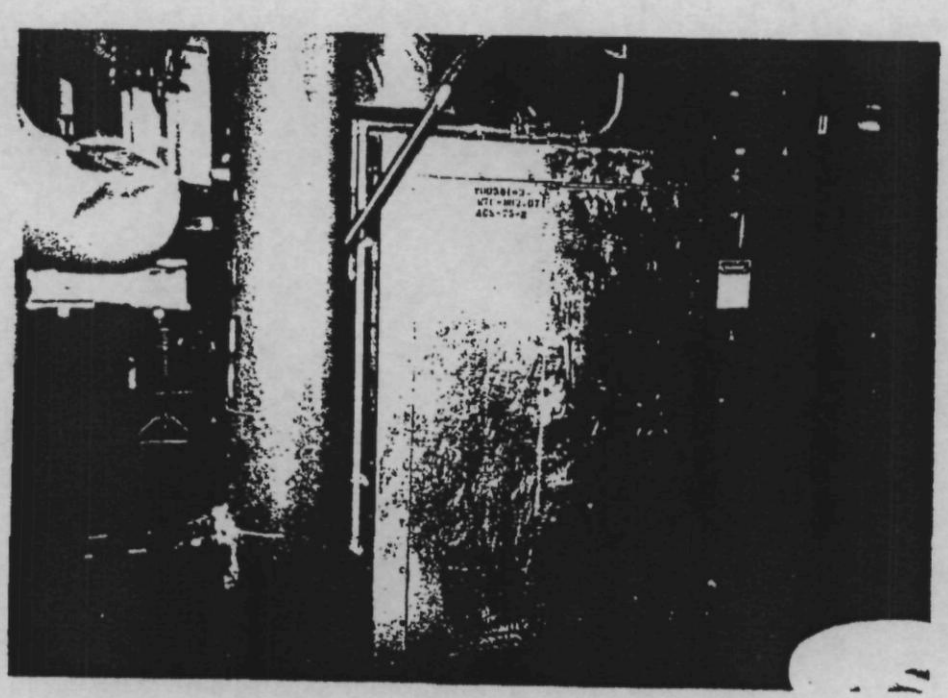
Photograph 24

Upgraded elevator lobby, by tenant



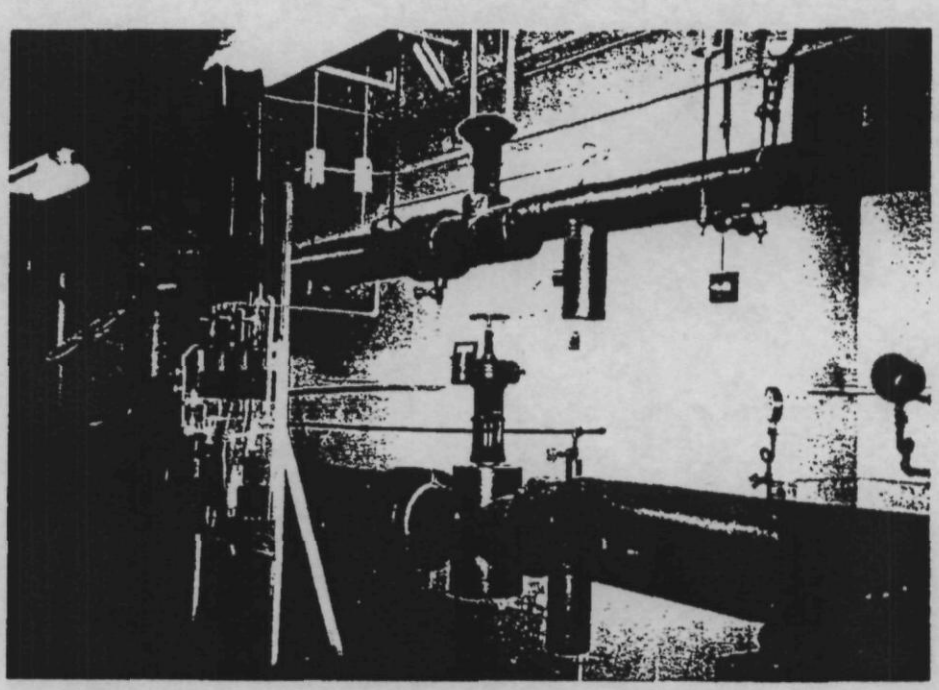
Photograph M1

Typical 7th floor mechanical room air handler and abandoned freeze protection pump system



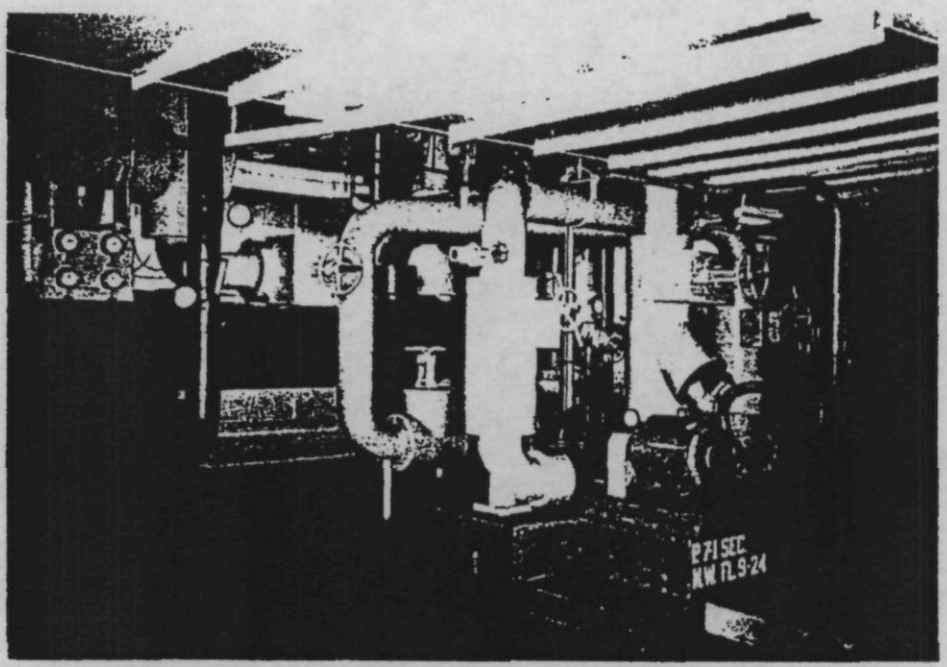
Photograph M2

New air handling unit for the electrical substation on the 74th floor



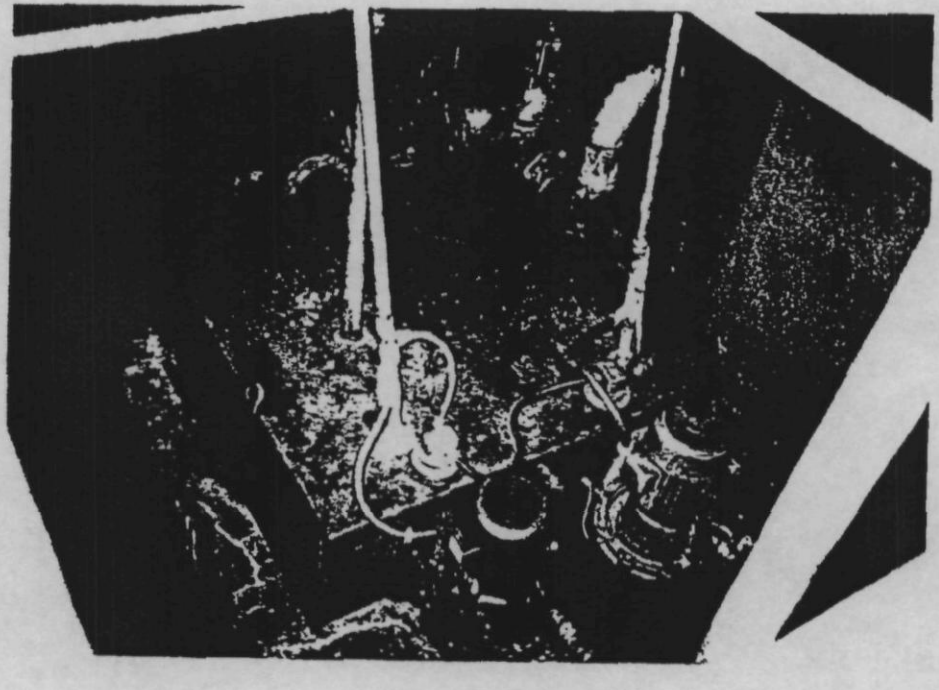
Photograph M3

Steam pressure reducing station



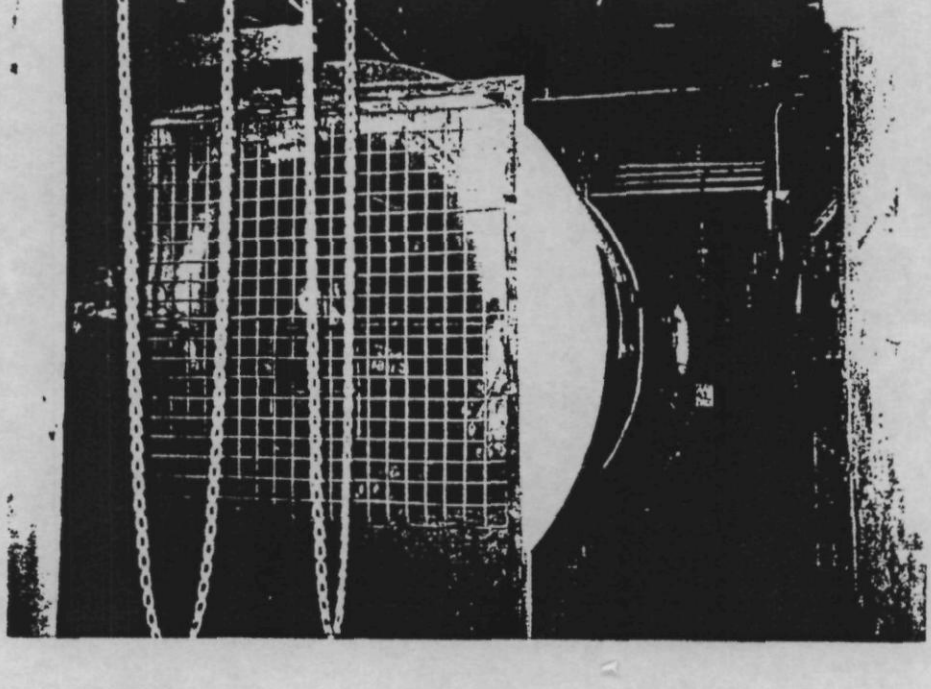
Photograph M4

Steam and chilled water heat exchangers and secondary heating/chilled water pumps



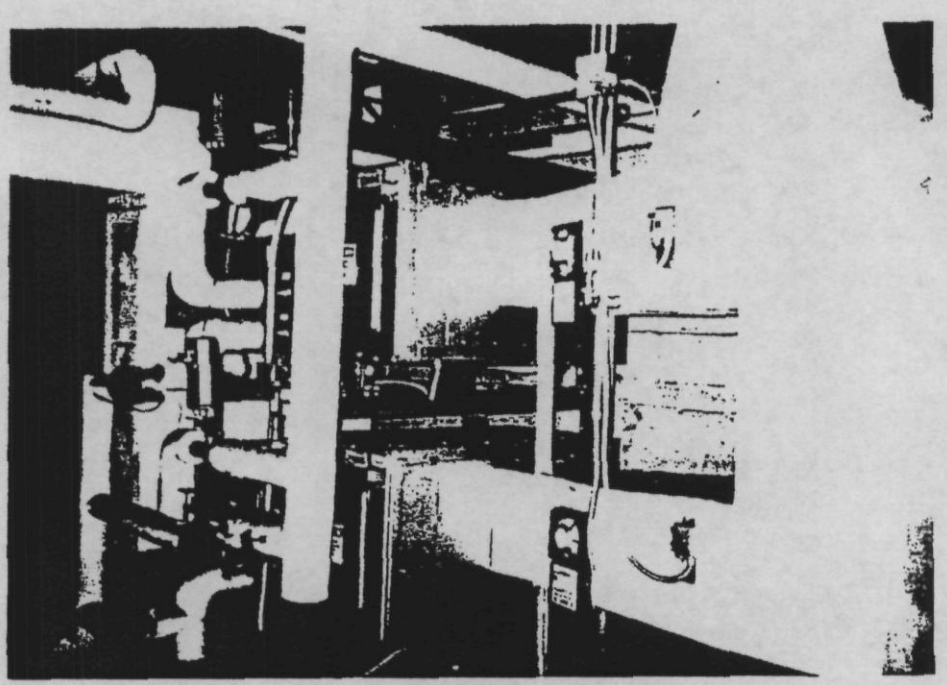
Photograph M5

Steam condensate return pumps and receiver in the B-6 Level mechanical room



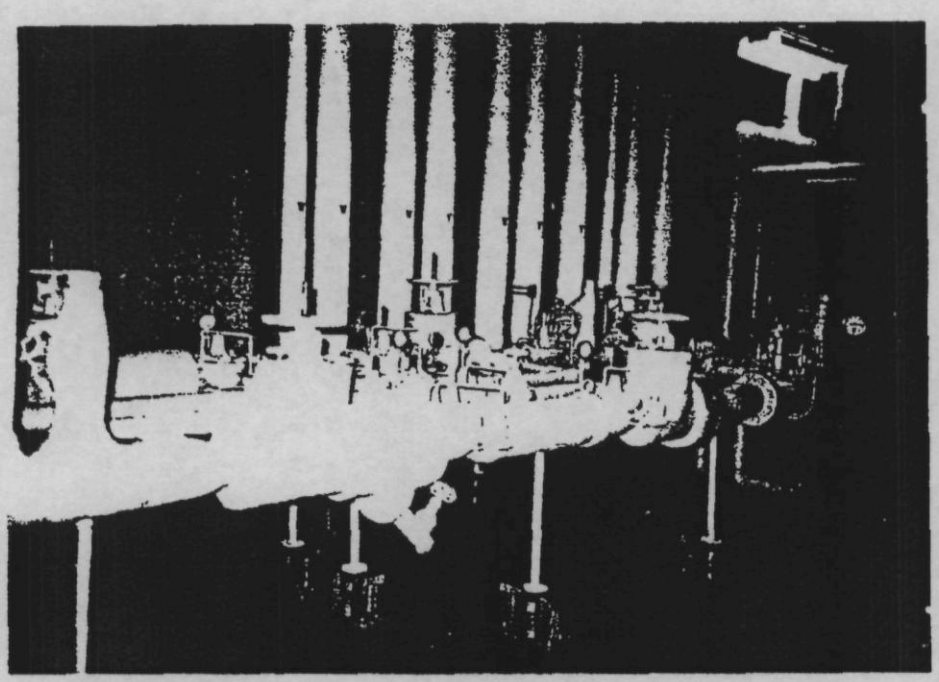
Photograph M6

7th floor mechanical room air handler return air fan



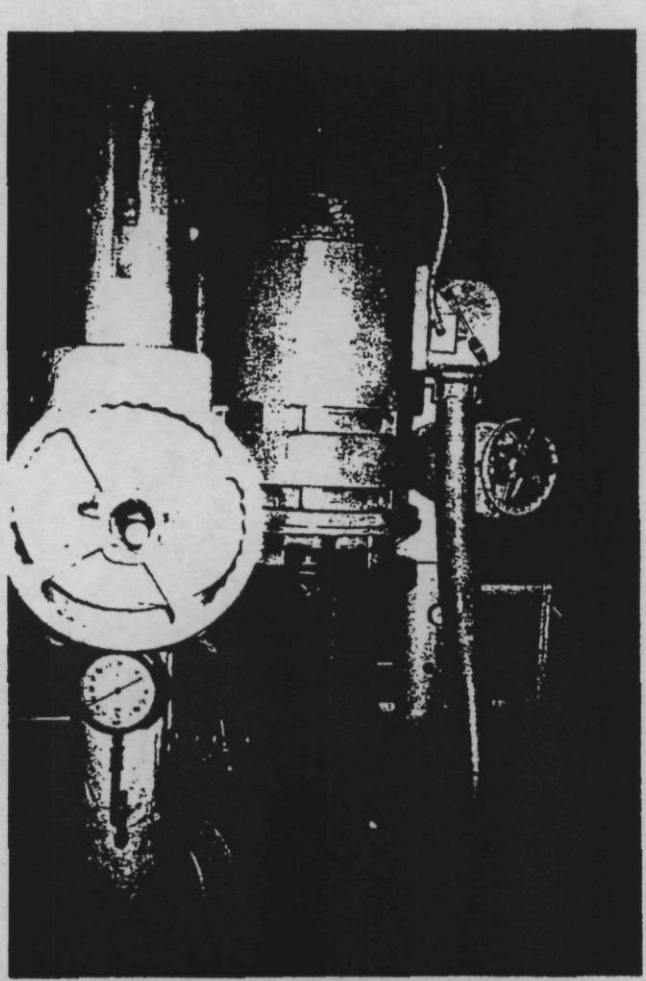
Photograph M7

New H&V units, with steam coils, located in the B-6 Level mechanical room



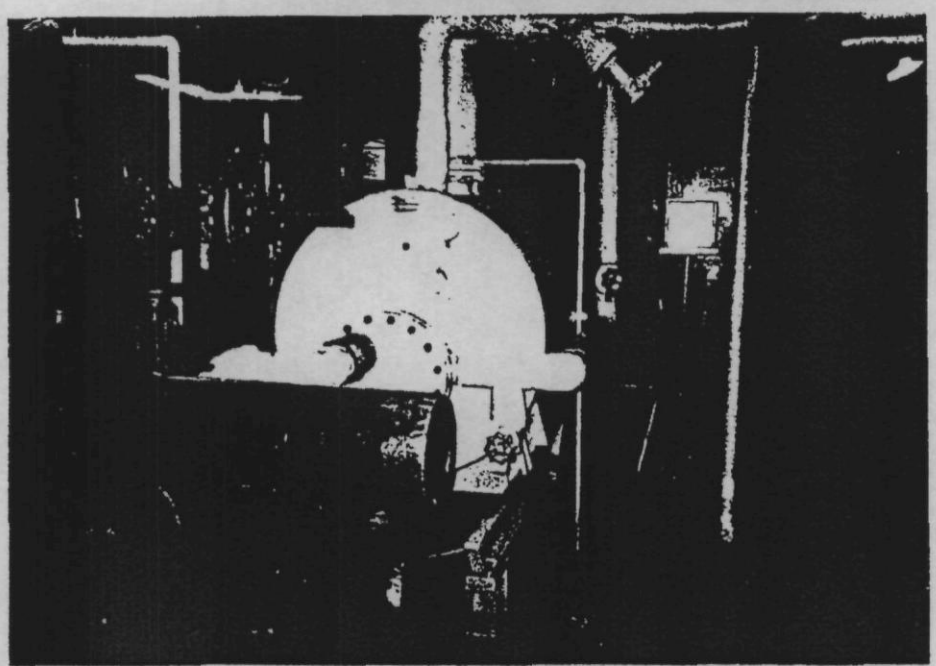
Photograph M8

Domestic water pressure reducing station



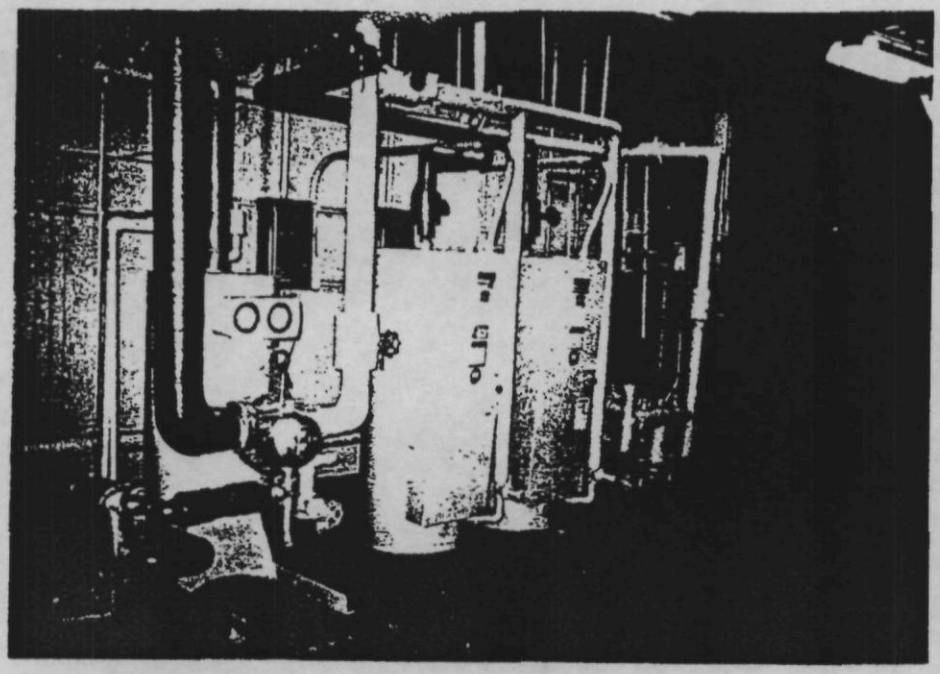
Photograph M9

Domestic water booster pump



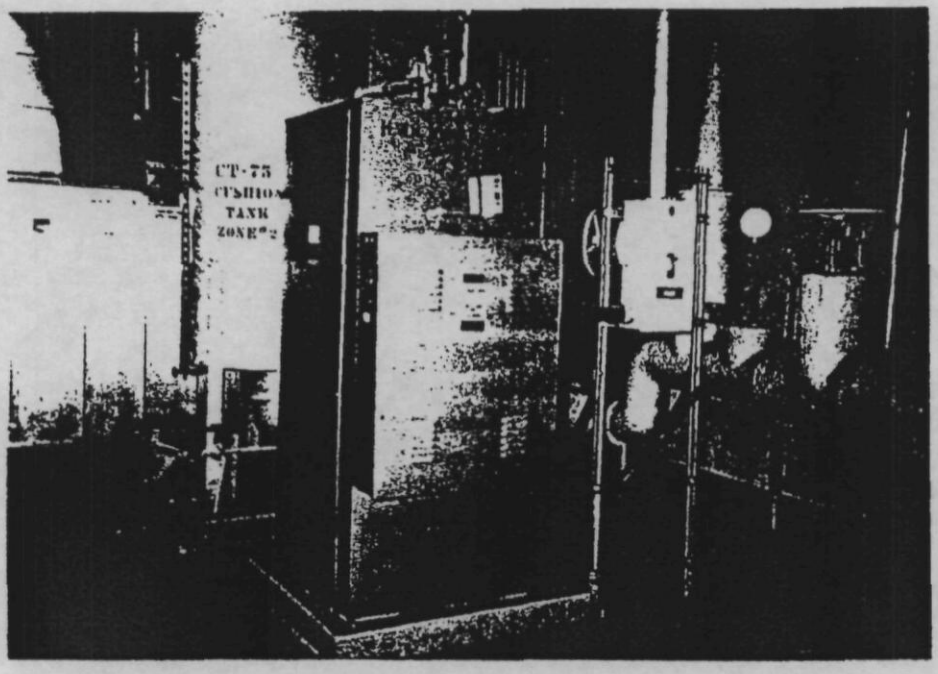
Photograph M10

Domestic water preheat tank



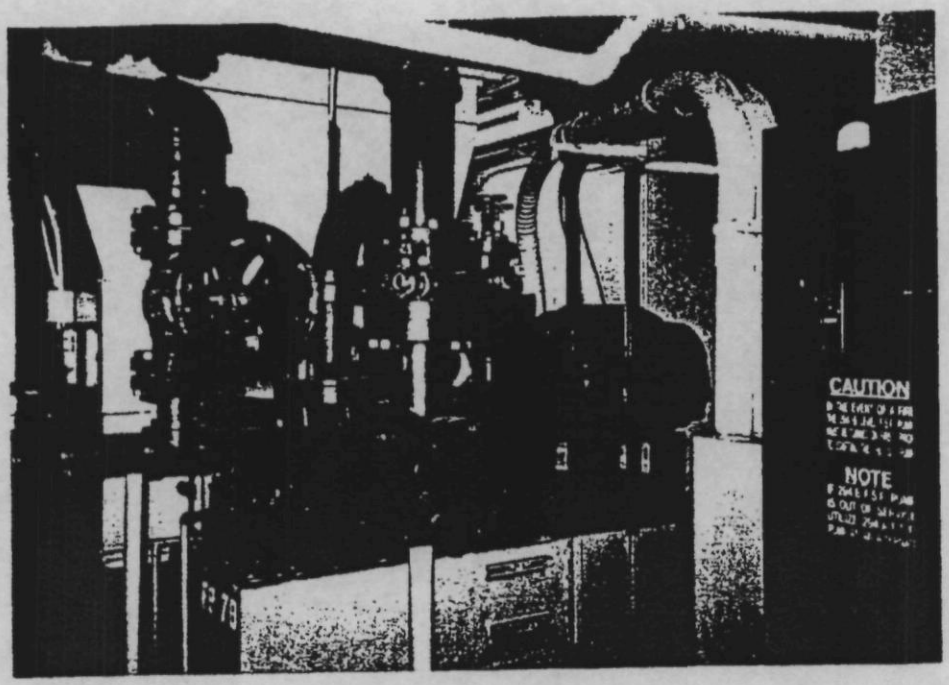
Photograph M11

Steam and electric domestic water heaters and circulating pumps



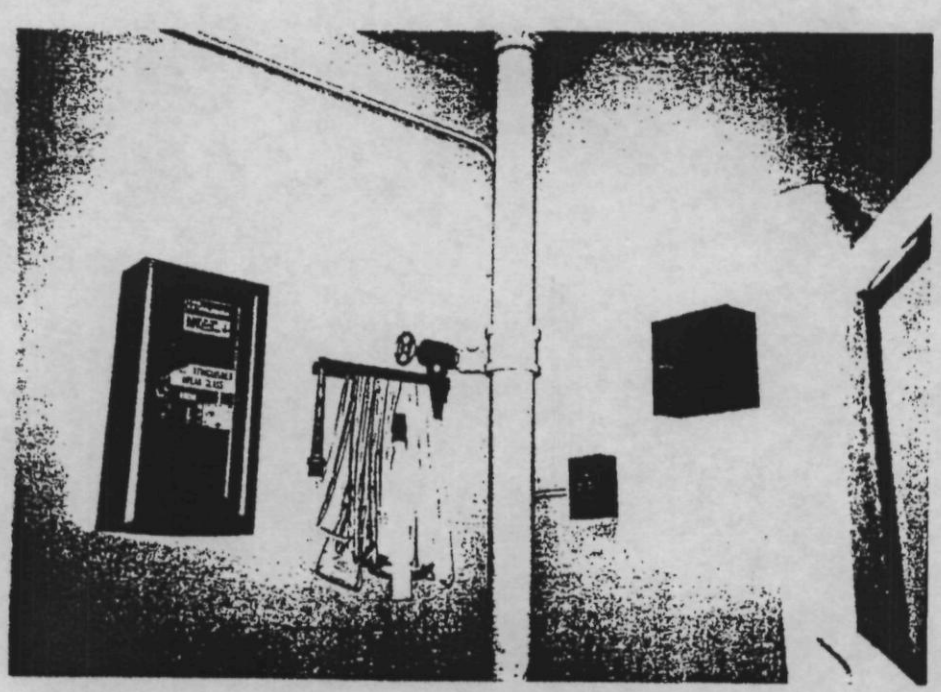
Photograph 12

Large electric water heater



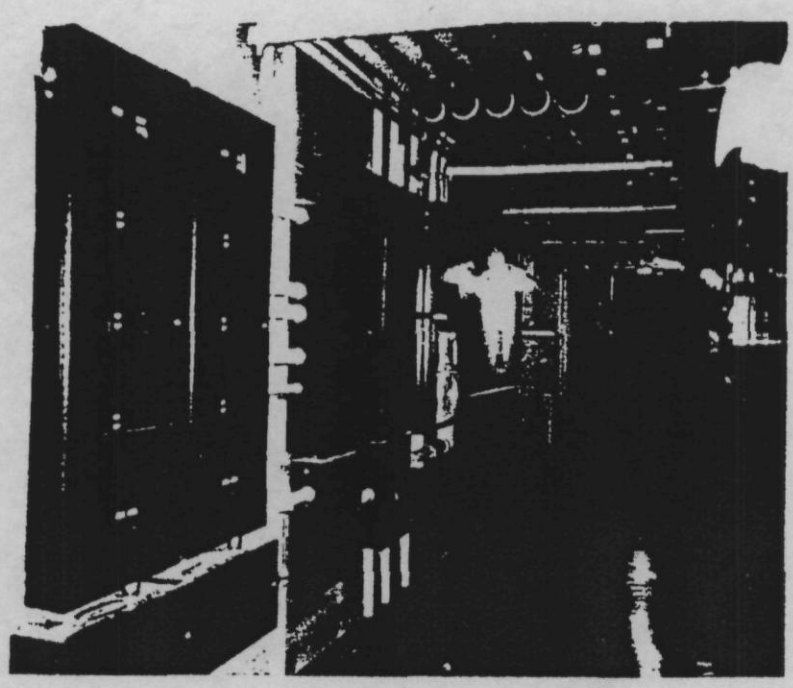
Photograph M13

Electric fire pump located in the 7th floor mechanical room



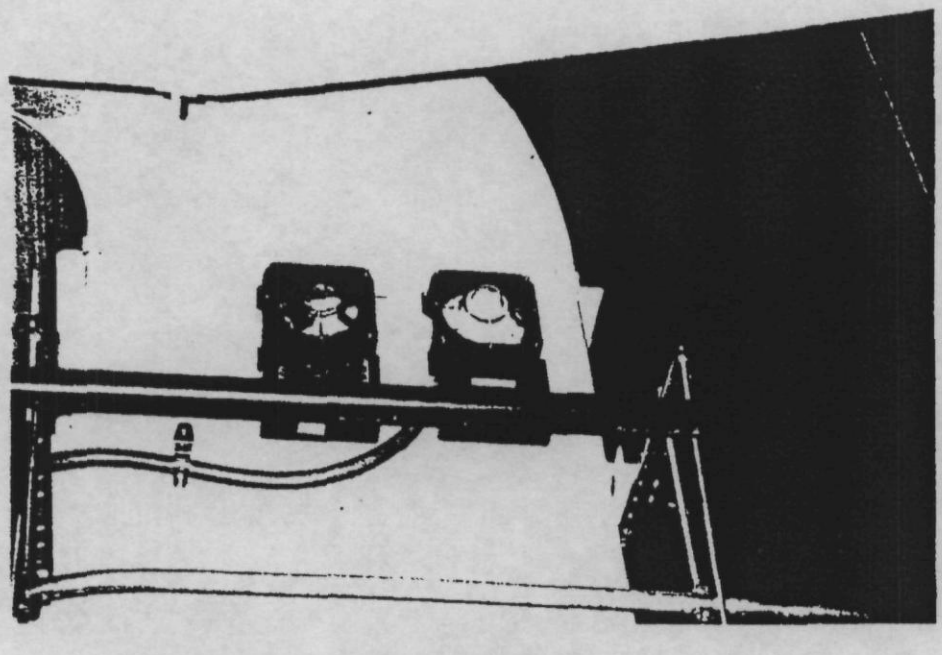
Photograph M14

Standpipe riser with a fire hose rack and fire extinguisher cabinet located in the stairs



Photograph M15

Fire alarm panels for the new system being installed



Photograph M16

Duct smoke detectors for a typical air handler

Photograph M17

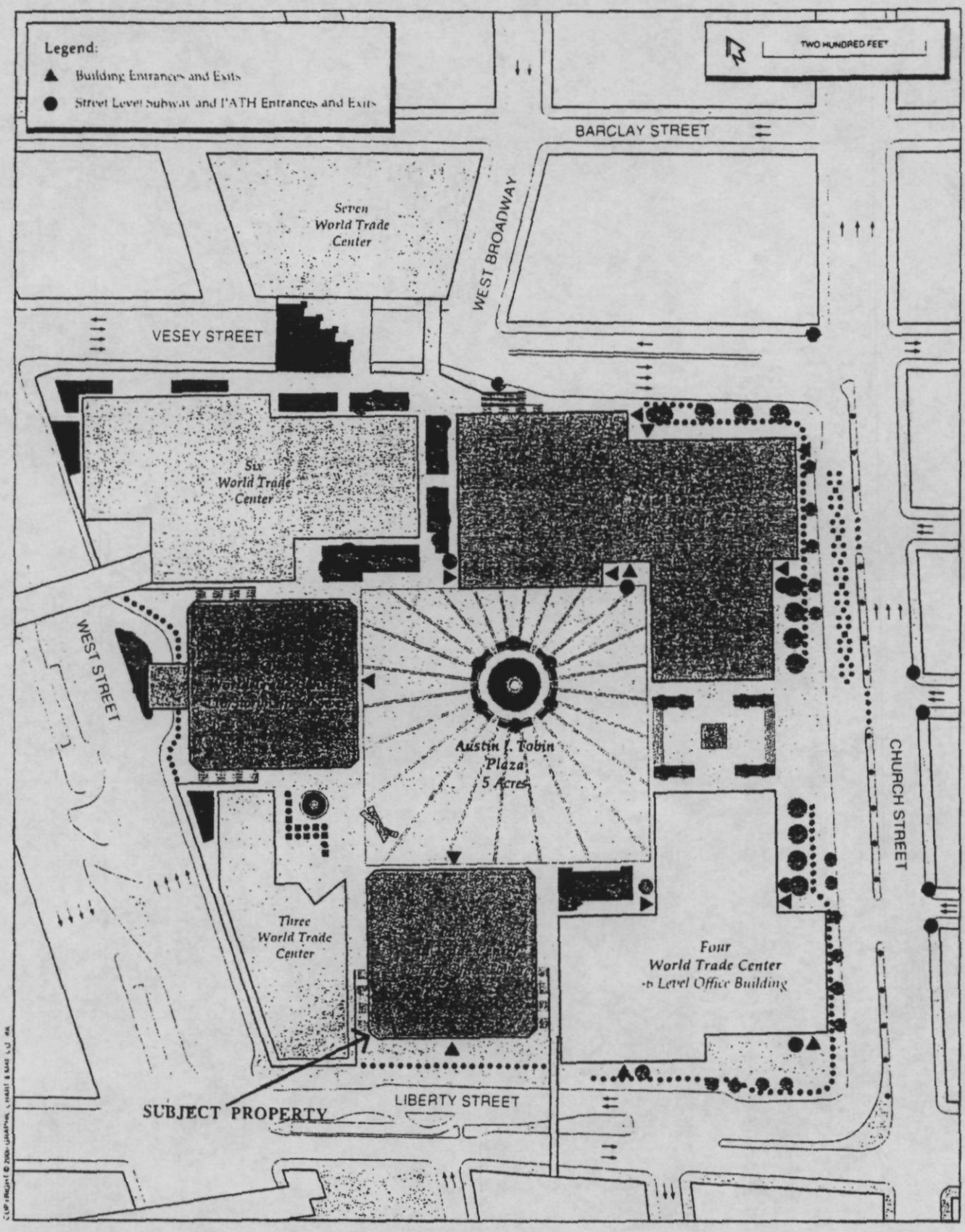
Exit sign, manual pull station, and alarm

ATTACHMENT 2

Site Orientation Map
(Reproduced with permission from J.P. Morgan Property Book)

JPMorgan

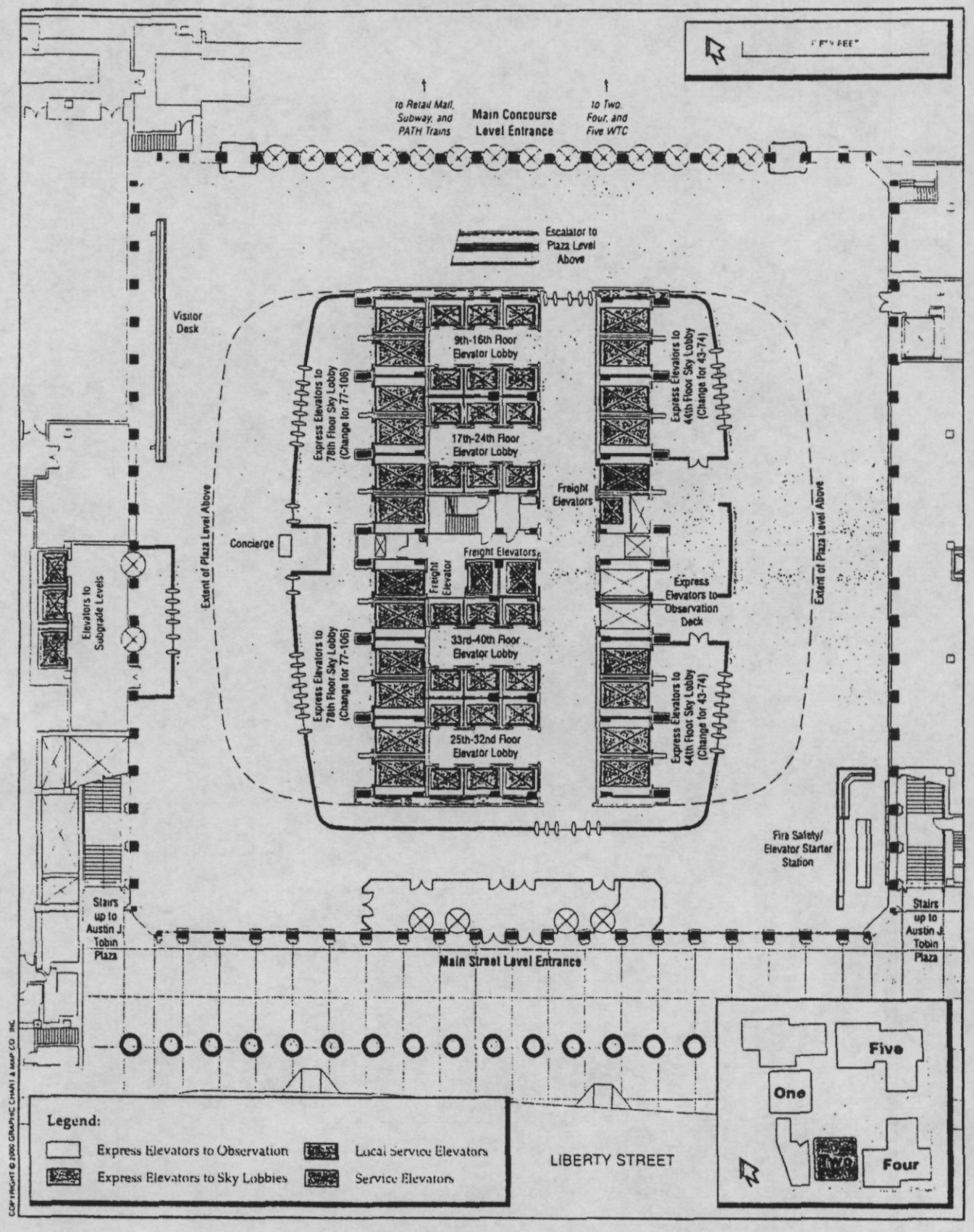
World Trade Center Site Plan



ATTACHMENT 3

Lobby floor plan
(Reproduced with permission from J.P. Morgan Property Book)

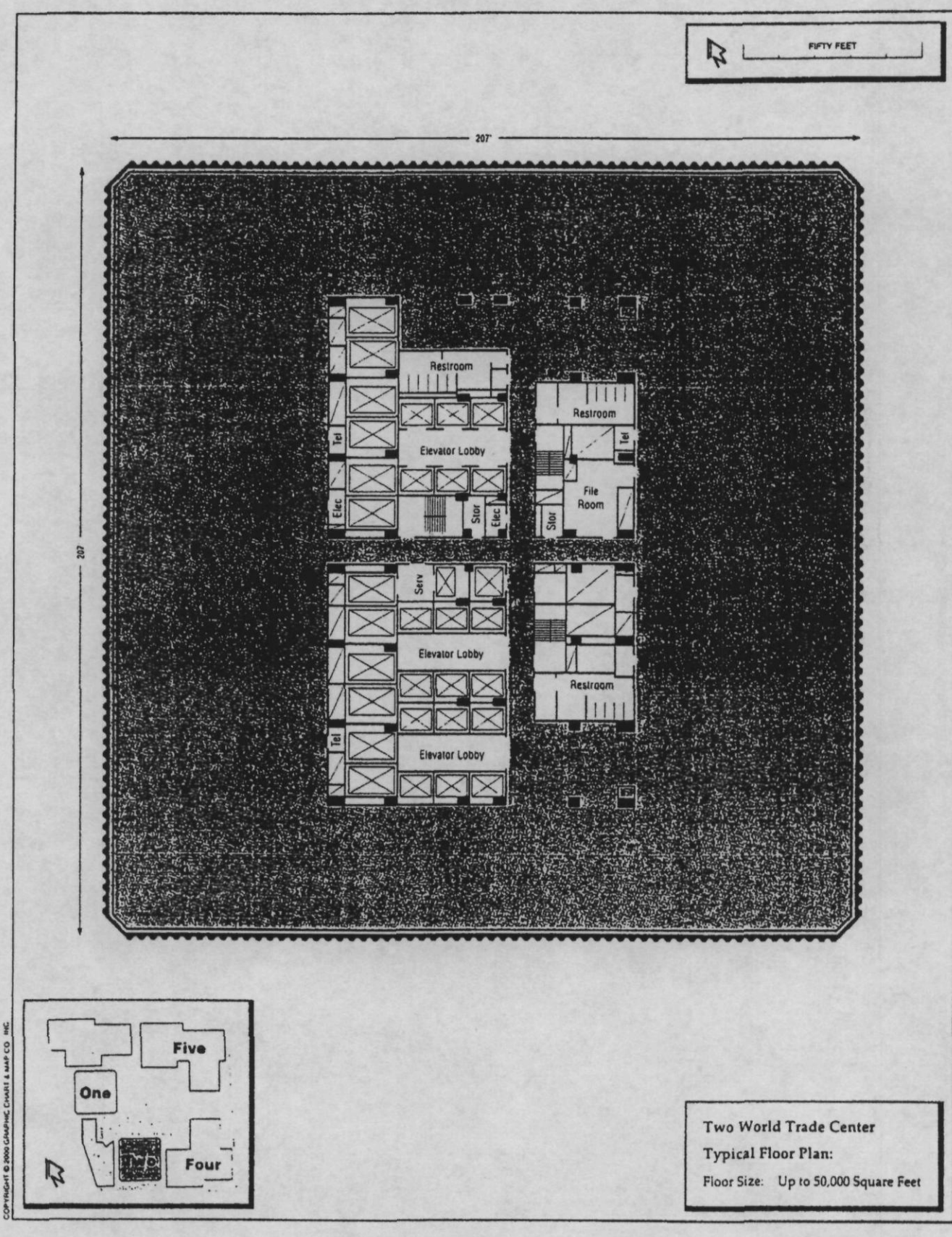
Two World Trade Center Lobby Floor Plan



ATTACHMENT 4

Typical floor plan
(Reproduced with permission from J.P. Morgan Property Book)

Two World Trade Center Typical Floor Plan



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Two World Trade Center

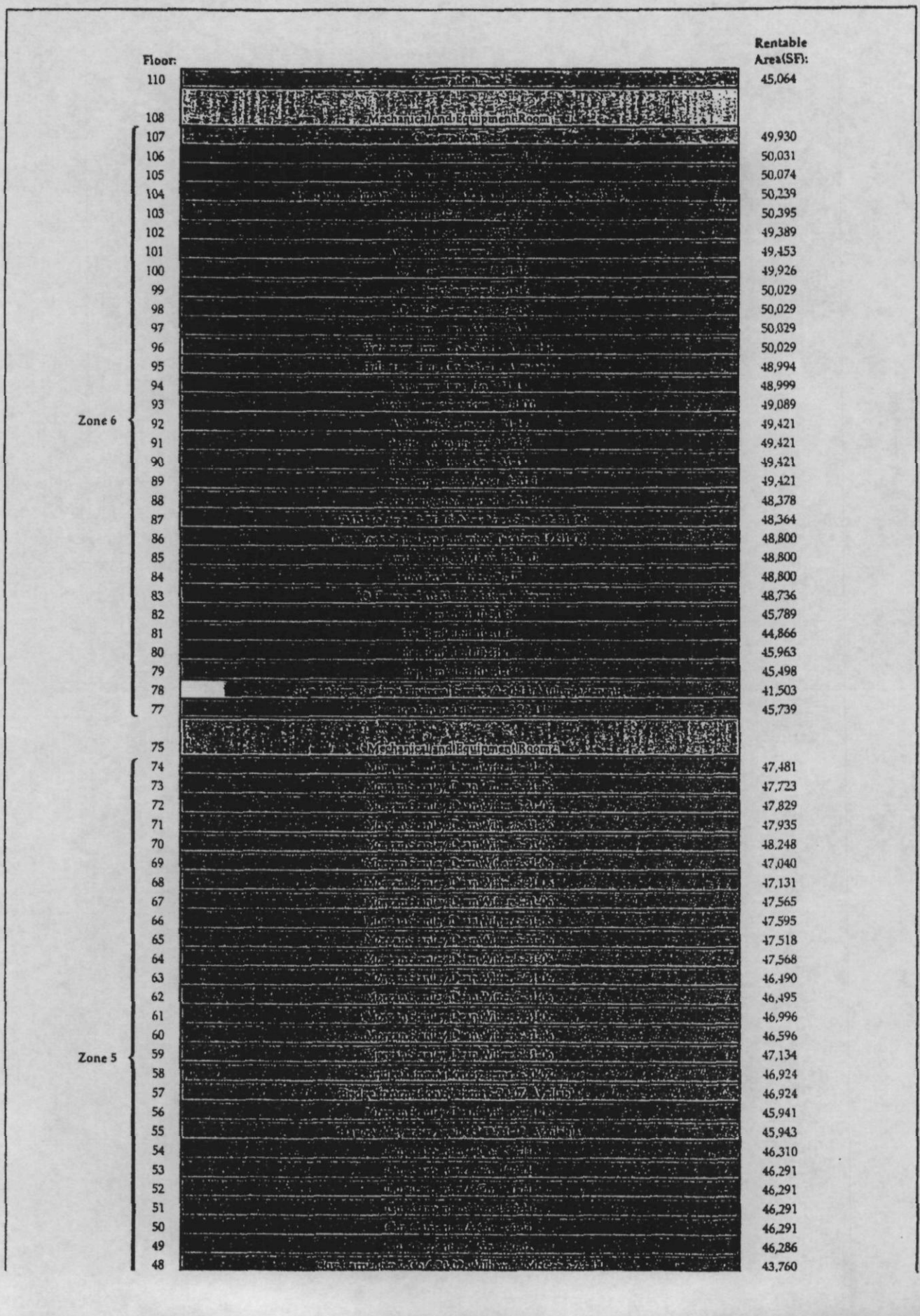
Typical Floor Plan:

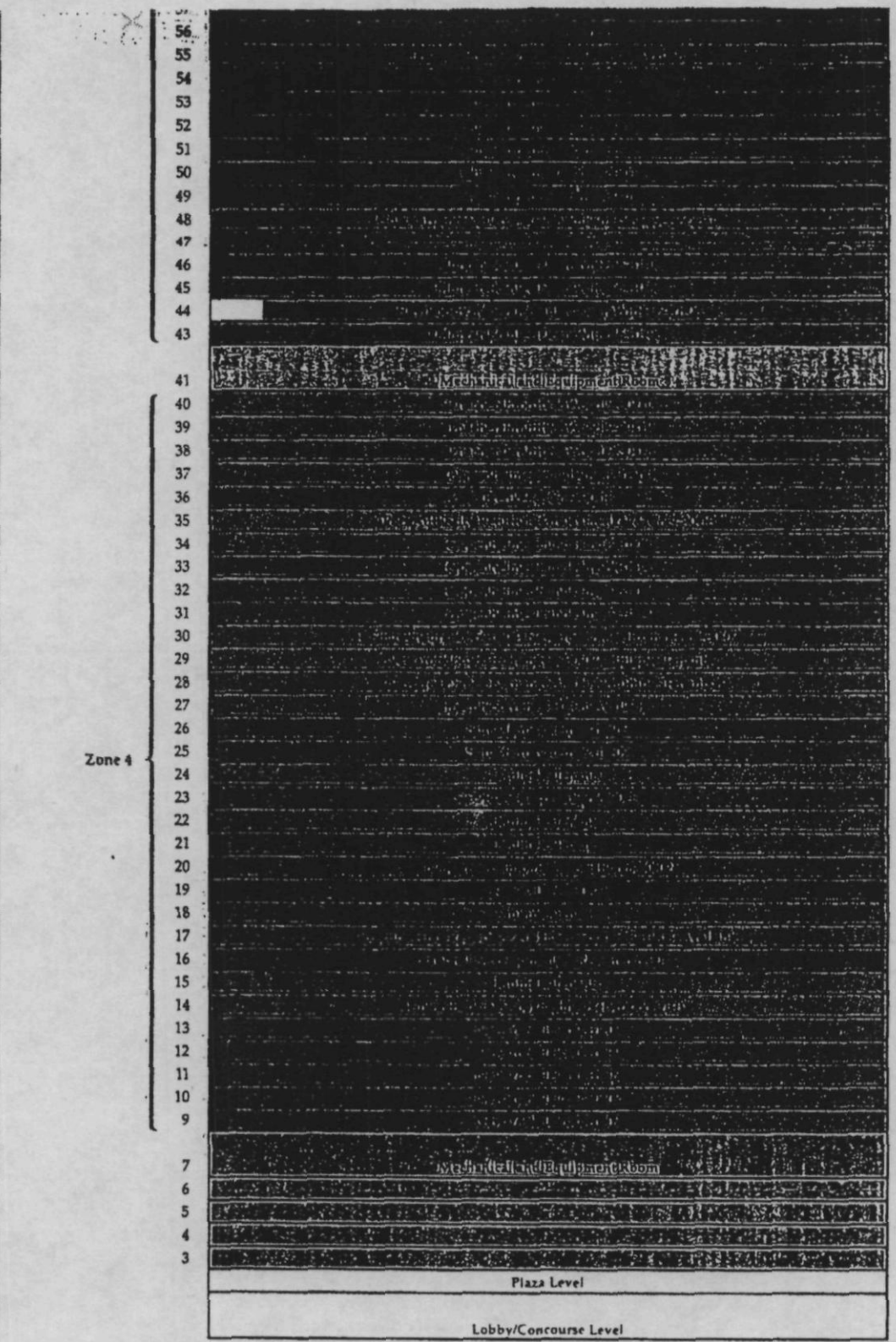
Floor Size: Up to 50,000 Square Feet

ATTACHMENT 5

Stacking Plan
(Reproduced with permission from J.P. Morgan Property Book)

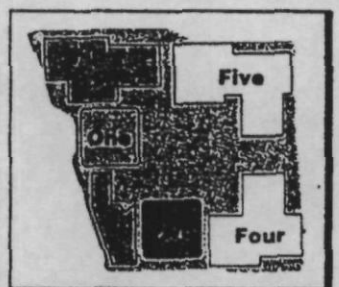
Two World Trade Center Tenant Stacking Plan





* AON subleases floors 101 to 103, 1/2 of 104 and 105 from Shearson until 8/2002 at which time they convert to a direct lease from the Port Authority. AON also has an option to lease the other half of floor 104 and 106.

4,470,598 Total



Legend:

- Port Authority
- Lobby
- Single Tenant Floors
- Amenity
- Multi-Tenant Floors
- Mechanical/Other

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ATTACHMENT 6

BOCA Group International Elevator Survey Report

BOCA GROUP
INTERNATIONAL, INC.
VERTICAL TRANSPORTATION CONSULTING

December 5, 2000

Mr. Robert Weiland
Merritt & Harris, Inc.
110 East 42nd Street
Suite 1200
New York, NY 10017-5685

RE: TWO WORLD TRADE CENTER
NEW YORK, NY
Vertical Transportation Study

Dear Mr. Weiland:

We are pleased to submit our preliminary report based on a visual inspection performed by our field engineers who visited the above referenced property on and a review of the documents made available to us in the offices of the Port Authority of New York and New Jersey.

OVERVIEW AND LAYOUT

There is a total of 93 passenger elevators in this building, 44 cars have been modernized, 4 in process of being modernized and 48 cars that are scheduled for modernization in the near future. There are 8 service elevators serving the building.

There are 72 local stop passenger elevators and 19 express stop passenger elevators serving the office floors (9-107). There are 2 express elevators serving the 107th floor. There are 3 Elevators outside the building foot print ("K" elevators) that serve the B1 to B6 levels (Tower 2 and all subgrade spaces). The vertical transportation system is divided into 3 vertical zones serviced from the main lobby and the 2 sky lobbies, which are at the 44th and 78th floors. There are 8 express elevators traveling from the lobby to the 44th floor sky lobby and 11 express elevators traveling from the lobby to the 78th floor sky lobby. The main lobby and the sky lobbies each access 4 banks (A, B, C, D) of 6 cars which provide local service to portions of their respective zones. Each local bank of 6 elevators serves approximately 8 stories.

There is one set of escalators serving the Lobby Level to the Plaza Level. There is a pair of escalators on each sky lobby floor, serving the floors above and below.

TWO WORLD TRADE CENTER

(Pre-selected elevators observed)

ELEVATOR #	FLOORS SERVED	CAPACITY	CONTRACT SPEED (FPM)	FUNCTION
5	B1, 6, 3, 4, 5, 6, 7, 9-40 & 44	10,000	1,600 FPM	PASSENGER / SERVICE
6	Front – 1 +107 Rear – B1, 6, 3, 4, 5, 44, 75, 77-107	10,000	1,600 FPM	PASSENGER / SERVICE
12	1 AND 78	10,000	1,600 FPM	PASSENGER HIGH RISE SHUTTLE
15	1 AND 78	10,000	1,600 FPM	PASSENGER HIGH RISE SHUTTLE
32	17-24	3,500	1,000 FPM	PASS
50	B4, B3, B2, B1, 1-7, 9-108	6,000	1,200 FPM	FREIGHT
K3	1, B1, SB1-SB5	3,500	250 FPM	PASS
FE6	B1-B4	8,000	150 FPM	HYDRAULIC FREIGHT

ESCALATORS

There are also eighteen (18) escalators serving this building. The following chart describes service provided by these modernized units.

UNIT #	FLOORS SERVED	RISE
B1 & B2	Concourse to Observation deck	22' 0"
B3 & B4	Floors 43 to 44	12' 0"
B5 & B6	Floors 44 to 45	14' 0"
B7 & B8	Floors 77 to 78	12' 0"
B9 & B10	Floors 78 to 79	14' 0"
B11 & B12	Floors 35 to 36	12' 0"
B13 & B14	Floors 37 to 38	12' 0"
B15 & B16	Floors 107 to 110	40' 5"
B17 & B18	Floors 108 to Roof	24' 3"

EQUIPMENT

ELEVATOR No. 5

A freight elevator driven by an Otis motor generator with an Otis relay type controller with an overhead gearless traction type machine.

ELEVATOR Nos. 6, & 50

Both being freight elevators driven by Otis motor generators with Swift type controllers. Both with overhead gearless traction type machines.

ELEVATOR NO.S 12 AND 15

Both are a passenger elevators considered high rise shuttles. Both using overhead gearless traction type machines. No. `12 elevator has been modernized, driven by SCR drive units with CEC swift futura controllers. No. 15 elevator has the original Otis motor generator with Otis relay type controller.

ELEVATOR NO. 32

Driven by Otis motor generator with Otis relay type controller. Machine type is gearless overhead traction.

ELEVATOR NO. K3

Driven by Otis motor generator with Otis relay type controller. Machine type is geared underslung traction.

ELEVATOR NO. FE6

Hydraulic freight elevator with ESCO relay controller with working pressure 285 and relief pressure 355.

ELEVATOR #	5-YEAR TEST TAG DATE	DATE OF EXPIRATION	STATUS
5	97	2002	CURRENT
6	2000	2005	CURRENT
12	99	2004	CURRENT
15	99	2004	CURRENT
32	99	2004	CURRENT
50	2000	2005	CURRENT
K3	97	2002	CURRENT

ELEVATOR #	ANNUAL TEST TAG DATE	DATE OF EXPIRATION	STATUS
FE6	99	2000	CURRENT

COMPLIANCE

The passenger elevator no.s 5, 6, 12, 15, 32, and K3 all have Fire Return Phase I and II. The machine rooms have smoke detectors. All elevators have emergency power with automatic transfer. The main lines are fused and lockout capable. Al required safety tests are up to date. The elevators fully comply with A.D.A. requirements.

The freight elevator no.s 50 and FE6 all have Fire Return Phase I and II. The machine rooms have smoke detectors. All elevators have emergency power with automatic transfer. The main lines are fused and lockout capable. All required safety tests are current.

CABS

PASSENGER ELEVATOR NO. 32

Has enamel metal wall panels with marble trim and a laminate canopy. The front of the cab is brushed stainless steel with two stainless steel car operating panels. LED position indicators over the door. Fluorescent lighting along the top corners of the cab. Rug floor, emergency lighting, intercom security features and fire return Phase II.

The car door is signal speed center opening 48 inches wide. The car uses a detector edge for reopening.

PASSENGER ELEVATOR NO.S 12, 15, 5, AND 6

Have marble walls with a stainless steel trim. Rug floors, high polished canopy with black border and recessed lighting. Cabs have a front and rear door opening. The front and rear are stainless steel each with a stainless steel car operating panel. L.E.D. position indicators above the front and rear doors. Emergency lighting, intercom security features and fire return phase II.

The car doors are two speed center opening front and rear with 62 inch wide openings. The cars use detector edges for reopening.

FREIGHT ELEVATOR NO. K3

Has gray laminate paneled walls with diamond plate strips to prevent interior damage. Drop ceiling with fluorescent lighting. Rug floor, the front of the cab is stainless steel, one car operating panel, emergency lighting, intercom security features and Fire Return Phase II.

The car door is single speed center opening 48 inches wide. The car uses a detector edge for reopening.

FREIGHT ELEVATOR NO. 50

Has stainless steel walls with bumper guards to protect from interior damage. The floors are made with diamond plate, stainless steel ceiling with fluorescent lighting. The cab has one car operating panel, L.E.D. position indicator, emergency lighting, intercom security features and fire return Phase II. The car is operated by an attendant at all times.

The car door is single speed center opening 54 inches wide.

FREIGHT ELEVATOR FE6

Has metal walls, screen ceiling with diamond plate floor. Cab is equipped with emergency lighting, intercom security systems, one car operating panel. Car has Fire Return Phase II.

The car door is a vertical gate with safety edge and a peelle vertical biparting shaftway door.

ELEVATOR CHARTS

2 WORLD TRADE CENTER – ZONE 1

ELEVATOR #	FLOORS SERVED	CAPACITY	CONTRACT SPEED (FPM)	FUNCTION	BANK
5	B1, 1, 3, 4, 5, 6, 7, 9-40, 44	10,000	1,600 FPM	FREIGHT	--
24-29	9-16	3,500	800 FPM	PASSENGER	A
30-35	17-24	3,500	1,000 FPM	PASSENGER	B
42-47	33-40	3,500	1,400 FPM	PASSENGER	D
36-41	25-32	3,500	1,200 FPM	PASSENGER	C
48	B1, 1, 2, 3-7, 9-40	5,000	800 FPM	FREIGHT	--
K3 & K4	1, B1, B1 - B6	4,000	250 FPM	PASSENGER	K
K5	1, B1, B1 - B6	6,000	250 FPM	PASSENGER	K

2 WORLD TRADE CENTER – ZONE 2

ELEVATOR #	FLOORS SERVED	CAPACITY	CONTRACT SPEED (FPM)	FUNCTION	BANK
1-4	FRONT 1 REAR 44	10,000	1,600 FPM	PASSENGER	LOW RISE SHUTTLES
8-11	FRONT 1 REAR 44	10,000	1,600 FPM	PASSENGER	LOW RISE SHUTTLES
17	B1, 1-4, 41, 44-74	10,000	1,600 FPM	FREIGHT	--
49	B1, 1, 3, 4, 5, 41-74	5,000	1,000 FPM	FREIGHT	--
51-56	44-54	3,500	500 FPM	PASSENGER	A
57-62	55-61	3,500	800 FPM	PASSENGER	B
69-74	68-74	3,500	1,000 FPM	PASSENGER	D
63-68	62-67	3,500	800 FPM	PASSENGER	C

2 WORLD TRADE CENTER

ELEVATOR #	FLOORS SERVED	CAPACITY	CONTRACT SPEED (FPM)	FUNCTION	BANK
K1	1, B1	6,000	100 FPM	SERVICE / FREIGHT	SUB-GRADE
K2	Front: B1 Rear: B4, B5 & B6	4,000	200 FPM	SERVICE / FREIGHT	SUB-GRADE
P1	Front: 1, B1, B2 & B4 Rear: B5	8,000	100 FPM	FREIGHT	SUB-GRADE

2 WORLD TRADE CENTER – ZONE 3

ELEVATOR #	FLOORS SERVED	CAPACITY	CONTRACT SPEED (FPM)	FUNCTION	BANK
75-80	78-86	3,500	500 FPM	PASSENGER	A
93-98	100-107	3,500	1,000 FPM	PASSENGER	B
87-92	90, 94-99	3,500	800 FPM	PASSENGER	C
81/86	87-89, 91-93	3,500	800 FPM	PASSENGER	B
12-15, 20-23	FRONT – 1 REAR – 78	10,000	1,600 FPM	PASSENGER	SHUTTLE
*16, 18, 19	FRONT – 1 +44 REAR 78	10,000	1,600 FPM	PASSENGER	SHUTTLE
6	REAR B1, 1, 2, 3, 4, 5, 44, 75, 77-107	10,000	1,600 FPM	FREIGHT	--
7	FRONT – 1, 107 REAR-B1, 1, 2, 44	10,000	1,600 FPM	FREIGHT	--
50	B4, B3, B2, B1, 1-7, 9-108	6,000	1,200 FPM	FREIGHT	--
99	106-110	4,000	100 FPM	FREIGHT	--

*INTERZONE ELEVATORS

EQUIPMENT

LOCAL ELEVATORS

MODERNIZED ELEVATORS

30, 35, 36-38, 40-27, 51-62, 75-80, 93-98 Consists of CEC swift futura controllers with SCR drive units. All Otis overhead gearless traction machines.

ORIGINAL ELEVATORS

24-29, 31-33, 63-74, 81-92 consists of the original Otis relay logic controller with motor generator sets. All overhead gearless traction machines.

IN PROCESS OF MODERNIZATION

Elevators 34 and 39 will be CEC swift futura controllers with SCR driver units. All Otis overhead gearless traction machines.

HIGH RISE SHUTTLES

MODERNIZED ELEVATORS
12, 13, 22 & 23 consists of CEC swift futura controllers with SCR drive units. All overhead gearless traction machines.

ORIGINAL ELEVATORS
14-16, 20-21 consists of the original Otis relay logic type controllers with motor generator sets. All being overhead gearless traction machines.

IN PROCESS OF MODERNIZATION
Elevator Nos. 18 and 19 to be CEC swift futura controllers with SCR drive units. Machine type original Otis overhead gearless traction machines.

6 & 7
Both have Swift type controllers with original motor generator sets. Both machines being overhead gearless traction.

FREIGHT ELEVATORS

K3-K5, K1 & P-1
Consists of original Otis relay logic controllers with motor generator sets. Machine type is basement geared traction.

5, 48, 17, 49, and 50
All original Otis relay type controllers with original motor generator sets. All machines being overhead gearless traction.

ELEVATOR No. 99
Has been modernized with a CEC swift futura controller. The 99 car has SCR drive unit with an offset basement traction machine.

ELEVATOR No. K2
Has original Otis relay logic controllers with original motor generator sets. Machine type is underslung geared traction.

If you have any questions, please do not hesitate to contact us.

Sincerely,

BOCA Group International, Inc.

Robert Wernon
Field Engineer
TWO World Trade Ctr Ven Trans Study 11-1-00.doc

BOCA GROUP
INTERNATIONAL, INC.
VERTICAL TRANSPORTATION CONSULTING

December 5, 2000

Mr. Robert Weiland
Merritt & Harris, Inc.
110 East 42nd Street
Suite 1200
New York, NY 10017-5685

Re: **WORLD TRADE CENTER**
NEW YORK, NY
Building Two
Theoretical Traffic Analysis

Dear Mr. Brady:

The following are the criteria and a summary of the results of our calculated elevator traffic analysis for Two World Trade Center:

CRITERIA

The following are the criteria used to analyze elevator traffic capabilities:

- **Maximum Five-minute Handling Capacity (# of People):** This is the approximate maximum number of passengers the elevator system can be expected to serve during a five-minute peak period. For a bank of elevators serving commercial office space, this should be no less than 10% to 12% of the total population this bank is expected to serve.

- **Maximum Five-minute Handling Capacity (% of Population):** This is the percentage of the total expected population served by the elevator bank represented by the maximum five-minute handling capacity. For a bank of elevators serving commercial office space, this should be no less that 10% to 12

- **Average Interval:** This is the average time interval between elevators passing a given floor in a particular direction during a peak period, assuming the elevators are evenly spaced throughout the building. Note that Average Interval is a design criteria, and is NOT the same as the "average waiting time", which cannot be directly calculated by theoretical means. For a bank of elevators serving commercial office space, the average interval should be no more than 35 to 45 seconds.

200 PARK AVENUE • NEW YORK, NY 10166
TELEPHONE (212) 983-7010 • FAX (212) 983-7011 • E-MAIL info@bocagroup.com
www.bocagroup.com

SUMMARY OF RESULTS

SHUTTLES

- The Zone 2 shuttle can achieve a maximum handling capacity of 18% of the population they serve, with an average interval of 25 seconds.
- The Zone 3 shuttle can achieve a maximum handling capacity of 22% of the population they serve, with an average interval of 22 seconds.

LOCAL BANKS

- The results for the local banks (A, B, C, D of any zone) can achieve maximum handling capacities ranging between 13-18% and average intervals of approximately 30 seconds.

The results described above show that the elevators in Two World Trade Center should provide acceptable service during peak traffic periods with a full population in the buildings.

Should you have any questions or should you need any clarifications on our report, please feel free to contact us. Thank you.

Sincerely,

BOCA GROUP INTERNATIONAL, INC.

Daniel DeBlasio

Daniel DeBlasio
Director of Engineering
World Trade Center - 2 Traffic Analysis.doc

ATTACHMENT 7

Crandlemere and Associates Asbestos-Containing Materials
Document Review & Evaluation

R. W. CRANDLEMERE & ASSOCIATES, INC.
PROTECTING BUSINESS AND THE ENVIRONMENT

ASBESTOS-CONTAINING MATERIALS

DOCUMENT REVIEW AND EVALUATION

TWO WORLD TRADE CENTER, SOUTH TOWER

NEW YORK CITY, NY 10081

Project #000095

Merritt & Harris, Inc. #20-251E

User:

Merritt & Harris, Inc.
Attn: Mr. Robert G. Weiland, V. P.
110 East 42nd Street, 12th Floor
New York City, NY 10017-5685

Date Issued: November 7, 2000

549 Columbian Street, Suite 305, Weymouth, MA 02190 Tel. (781) 340-6161 Fax (781) 340-9191

The Asbestos-Containing Materials Document Review and Evaluation described herein was conducted by the undersigned, of R W Crandlemere & Associates, Inc. (CRANDLEMERE & ASSOCIATES). CRANDLEMERE & ASSOCIATES assessment consisted solely of the activities described in the Introduction of this report. The assessment was conducted in accordance with the Scope of Work in our Proposal No 00-090. It is subject to the Limitations and Service Constraints as provided in Appendix A of our ASTM Phase I Environmental Site Assessment report prepared as part of this Project. See Appendix F of that report for ASTM definitions of terms in italics in this report

Report Prepared by:

R. Wayne Crandlemere
President

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1.1 Background
1.2 Scope of Work

2.0 SUMMARY OF REVIEW OF DOCUMENTS 4

APPENDICES

Appendix A Back Up Documentation

1.0 INTRODUCTION

R. W. Crandlemere & Associates, Inc. (CRANDLEMERE & ASSOCIATES) was retained by Merritt & Harris, Inc. (the *user*) to conduct an ASTM E1527-97 Phase I *Environmental Site Assessment* (ESA) of One, Two, Four and Five World Trade Center, located in the Borough of Manhattan, New York City, New York, 10081.

It is our understanding that Merritt & Harris, Inc. is providing this information in conjunction with, and as part of, a larger assessment of the *property* and has named The Port Authority of New York and New Jersey as an *additional user* as defined by the ASTM Standard E1527-97 Section 3.3.39. As an *additional user*, The Port Authority of New York and New Jersey may rely on the information presented in this report.

This report presents CRANDLEMERE & ASSOCIATES' professional opinion, and no warranty, expressed or implied, is made. The Port Authority of New York and New Jersey has the right to reproduce in full and provide copies of this report to interested parties. All reports, both verbal and written, are for the benefit of The Port Authority of New York and New Jersey and its' agents, employees, participates, and assigns.

On September 26, 27, 28 and 29 and October 10 and 11, 2000 Mr. R. Wayne Crandlemere of CRANDLEMERE & ASSOCIATES conducted a *Site visit* to identify *recognized environmental conditions* at the Site. In addition, CRANDLEMERE & ASSOCIATES' assessment included reconnaissance of adjacent properties, background research, and review of available local, state and federal regulatory records regarding the presence of petroleum products or hazardous materials at or in the vicinity of the Site.

The results of our work regarding the ASTM Standard for a Phase I Environmental Site Assessment of the Site is provided in a separate Phase I ESA report.

This report addresses the asbestos-containing materials (ACM) related to the Two World Trade Center, South Tower (including elevator, façade, and asbestos issues for this building). See the separate reports specifically related to the One World Trade Center, Four World Trade Center, Five World Trade Center, Retail Mall and Plaza, Central Services and Subgrade for ACM information specific to those buildings and facility areas.

1.1 Background

The World Trade Center was constructed between 1966 and 1970 when asbestos was used in buildings as a fire retardant. According to the World Trade Center Property Book (see Section 3.4), "sprayed on asbestos is present within the 6th floor catwalks, mezzanine substructure, elevator shafts and machine rooms, interior core pipe chases, and electric and phone closets of the Twin Tower buildings. Additionally, asbestos-containing thermal system pipe insulation is present in pipe chases, the Concourse ceiling plenum and in MERs [mechanical equipment rooms], while vinyl asbestos floor tiles are present throughout the complex. The Port Authority has removed a large portion of the asbestos material typically located on the structural columns and on pipe insulation from tenant

floors in One World Trade Center, and has removed much of the pipe wrap insulation found in the Subgrade. The practice of containment has not been implemented at the World Trade Center."

"In addition to full-scale abatement projects, the World Trade Center has instituted an ongoing operations and maintenance program whereby specific individuals on the staff are trained as certified ACM handlers and can respond with appropriate equipment and procedures to manage incidental ACM incidents. Tenants whose space may contain ACM have been formally notified."

1.2 Scope of Work

Beyond the Scope of Work for the ASTM Standard for a Phase I Environmental Site Assessment, but as required by the *user*, summaries of readily available information (provided by and apparently prepared by the Port Authority of New York and New Jersey) pertaining to the presence of asbestos-containing building materials (ACBM) and documentation of the work done to abate ACBM was evaluated. No sampling or analysis was included and this is not to be interpreted as a complete asbestos survey.

Please note: There is reported litigation in progress for cost-recovery of money related to ACM abatement and/or management. This litigation was not evaluated as part of this assessment and the *user* should consider a detailed review of the on-going litigation and make their own determination as to the impact, if any, on their use of this report and/or future impact of the litigation on their decision making process related to the World Trade Center. Further, the information presented in this report is based at least in part on a somewhat arbitrary separation of areas of the complex that may or may not have any basis in the current operation of the Complex as it is currently managed as one facility. The *user* should consider this report as a good faith effort to present ACM related information to the subject area, however, the *user* is encouraged to review the ACM related Section of the Phase I Environmental Site Assessment (ESA) report which provides a summary of all ACM related information provided by the *owner*. Included in Appendix H-7 of the ESA report are copies of the asbestos program highlights as presented in the World Trade Center Environmental Programs 1999 Year End report. This includes a summary of 1999 Asbestos Projects, World Trade Center Asbestos Disclosure, World Trade Center Elevator Shaft Asbestos Assessment, and World Trade Center Asbestos Contract Administration procedures. Portions of those documents are included in this report. Additionally, the *user* should consider an independent review of the information provided.

It should also be noted that certain materials such as fire doors were not included in the materials suspected to be asbestos-containing and have not been tested or otherwise investigated. It was reported that testing of spline ceilings, hung ceilings, wallboard and wallboard joint compound determined that they were not ACM throughout the facility. A review of test results was not performed and we cannot verify the adequacy of such testing. The *user* may wish to further investigate such materials.

There have been significant on-going asbestos abatement projects and cost estimates provided by the *owner* indicate the following estimated removal costs:

Material	Removal Cost
Vinyl asbestos Tile (VAT)	$ 5-6/square foot
Sprayed-on Fireproofing	$20-25/square foot
Thermal System Insulation (TSI)	$15/linear foot

The actual costs for VAT removal for 1999 projects are provided in Appendix H-7 of the Phase I ESA report.

Documentation regarding the presence of ACM in elevator shafts is presented by shaft designation. It is unclear where the shafts are located within the facility and the *user* should consider cross-referencing the shaft locations to the area under consideration. Mr. Taylor reported that there are forty (40) shafts that contain ACM within the Center.

3.0 SUMMARY OF REVIEW OF DOCUMENTS

Materials known to be present in Two World Trade Center (excluding mechanical equipment rooms, truck dock and subgrade locations) appear to include:

Material	Amount
Spray-on fireproofing	64,440 square feet
Cementitious insulation behind convector units	90 square feet
Thermal system insulation (TSI)	1,430 linear feet
Exhaust duct insulation	1,000 linear feet
Elevator pits and shafts	As noted in documents
Vinyl asbestos tile (VAT)	1,734,032 square feet

Additionally, the following ACM was reported:

Mechanical equipment rooms	25,000 square feet spray-on fireproofing and unknown quantities of TSI
Roof	Could contain asbestos

APPENDIX A

2 WTC

Excluding MERs, Truckdock, Subgrades, and Elevator Shafts

Location	Floors	Amount
Floors with less than 160 sqft* of sprayed-on fireproofing:	9 Floors	1,440 sqft
TOTAL:		1,440 sqft

** Classified as "Random Locations On Floor" in WTC Disclosure Memorandum*

Floors with less than 10 sqft of cementitious insulation behind convector units*:	9 Floors	90 sqft
TOTAL:		90 sqft

** Classified as "Convector Units" in the WTC Disclosure Memorandum*

Full Floor Locations:		
Floor locations with sprayed-on fireproofing:	4 Floors	20,000 sqft
6th Floor Plus Catwalk	1 Floor	35,000 sqft
	TOTAL:	56,530 sqft

** Classified as "Full Floor Locations" in the WTC Disclosure Memorandum*

Tenant Kitchen Exhaust Duct	2 Floors	1,000 lnft
Suspect Thermal System Insulation On Vertical Steam Line:	B6 – 108th Floor	1,430 lnft
	TOTAL:	2,430 lnft

WILL INCLUDE VAT FIGURES

THE PORT AUTHORITY OF NY & NJ **Memorandum**

TO: Abraham Friedman
FROM: Joe Amatuccio
DATE: September 27, 2000

SUBJECT: **ASBESTOS DISCLOSURE:**
Two World Trade Center: 27th Floor.

COPY: A. Burton, J. Ciccolello, T. Lynch, E. Monteverde, P. Taylor, F. Varriano, L. Zucchi

Regarding your inquiry as to the presence of asbestos-containing building materials present on the 27th floor in Two World Trade Center, our site survey and bulk sampling data base indicates the following:

On the 27th floor, there is no asbestos-containing sprayed-on fireproofing or thermal system insulation material present, as defined by the U.S. Environmental Protection Agency standard 40 CFR Part 61: National Emissions Standard For Hazardous Air Pollutants; Asbestos – Final Rule and the U.S. Occupational Safety and Health Administration standard 29 CFR 1910.1001: Asbestos, within the leasehold area. Asbestos-containing sprayed-on fireproofing is however present behind the core walls, but not the within the core's plenum. Vinyl asbestos floor tiles have been identified on the west, east, and south quadrants of the floor.

Should you have any questions, please contact me at x 2704.

Joe Amatuccio
Manager,
Operations & Maintenance Management

THE PORT AUTHORITY OF NY & NJ MEMORANDUM

TO: Joseph Amatuccio, Carla Bonacci, Jerrold Dinkels, Frank DiMartini, Eric Hauser, Louis Menno, Edwin Monteverde, Francis Riccardelli, Nancy Seliga

FROM: John Castaldo

DATE: September 19, 2000

SUBJECT: **ASBESTOS POSITIVE LOCATIONS AT THE WORLD TRADE CENTER: UPDATE.**

REFERENCE: J. Castaldo to Addressees; Memorandums Dated 5/4/98 and 12/21/99; Same Subject.

COPY: L. Ardizzone, S. Benjamin, I. Chachkes, J. Connors, W. Devlin, M. Finegold, M. Hurley, M. Jakubek, M. Kirshner, T. Lynch, U. Mehta, G. Meyer, R. Muessig, C. Nanninga, A. Reiss, E. Strauss, G. Tabek, P. Taylor, F. Varriano, L. Zucchi, Operations Control Desk, S-4's

Attached please find an update to my initial May, 1998 memorandum wherein the known asbestos locations at the World Trade Center were disclosed. The information provided in this disclosure is a compulation of avaliable bulk sampling and analytical results from both the World Trade and Engineering Departments' data bases.

In compliance with the disclosure requirements of the U.S. Occupational Safety and Health Administration's asbestos standard, I am requesting that this information be distributed to all World Trade Department, Engineering Department, PA Office Space, and Leasing Division property managers, project managers, construction managers, construction inspectors, operations supervisors, security supervisors, facility maintanence supervisors, and leasing agents associated with the allocation of space, and the design and implementation of World Trade Center projects. Additionally, please forward this information to those contractors under your administration. If there are questions as to the presence of asbestos-containing materials at a particular location, or if the scope of demolition and/or renovation work may impact asbestos-containing materials, please contact Art Burton, Assistant Environmental Coordinator, at 435-8364.

Those on the copyline are requested to contact this office for the appropriate response action if asbestos-containing materials may be impacted by work under your jurisdiction. The Port Authority complies with Industrial Code Rule #56 relative to worker certifications, contractor licensing, and work procedures if asbestos is going to be disturbed or impacted. Please contact me at 435-8518 should you have any questions.

John Castaldo
General Manager,
Base Building Services

World Trade Center Elevator Shafts With Asbestos-Containing Surfacing Insulation Material

One World Trade Center

Pits and Shafts

1 / 2	39 / 40 / 41
3 / 4	42 / 43 / 44
5 / 48	45 / 46 / 47
8 / 9	51 / 52 / 53
16 /17	54 / 55 / 56
49	57 / 58 / 59
18 / 19	60 / 61 / 62
20 / 21	63 / 64 / 65
22 / 23	66 / 67 / 68
50	69 / 70 / 71
24 / 25 / 26	72 / 73 / 74
27 / 28 / 29	
30 / 31 / 32	
33 / 34 / 35	
36 / 37 / 38	

Two World Trade Center

Pits and Shafts

5 / 48	36 / 37 / 38
10 / 11	39 / 40 / 41
14 / 15	42 / 43 / 44
24 / 25 / 26	45 / 46 / 47
27 / 28 / 29	54 / 55 / 56
30 / 31 / 32	57 / 58 / 59
33 / 34 / 35	63 / 64 / 65

-

There is no asbestos-containing surfacing insulation material in the J and K elevator cars in 1 and 2 WTC.

There is no asbestos-containing surfacing insulation material with the elevator shafts in 4 and 5 WTC.

Asbestos-Containing Surfacing And/Or Thermal System Insulation Materials Located In One World Trade Center - Exclusive Of Elevator Shafts

Full Floor Locations	Random Locations On Floor	Subgrades	Convector Units
- Lobby Mezzanine	- 43rd / 44th Floor PA Exhaust Duct	- B1 Level:	- 77th Floor
- 1st - 6th Floors: Core	- 82nd Floor	- Core, N/E Quadrant	- 79th Floor
- 6th Floor Catwalk	- 104th Floor	- B6 Level	- 88th Floor
- 7th / 8th Floor MER	- Core Electric Closets On The 1st – 40th floors		- 101st Floor
- 41st / 42nd Floor MER	- Perimeter Electric Closets On The 30th Floor		- 103rd Floor
- 75th / 76th Floor MER			- 105th floor
- 108th / 109th Floor MER			

Asbestos-Containing Surfacing And/Or Thermal System Insulation Materials Located In Two World Trade Center - Exclusive Of Elevator Shafts

Full Floor Locations	Random Locations On Floor	Quadrant Location	Convector Units
- 6th Floor Catwalk	- Lobby Mezzanine	- S/W, 43rd Floor Kitchen Exhaust Duct	- 22nd Floor
- 10th – 13th Floors (Bell Atlantic)	- 7th / 8th Floor MER		- 24th Floor
- 41st / 42nd Floor MER	- 9th Floor		- 59th Floor
	- 19th Floor		- 72nd Floor
	- 20th Floor		- 79th Floor
	- 26th Floor		- 81st Floor
	- 33rd Floor		- 84th Floor
	- 71st Floor		- 86th Floor
	- 75th / 76th Floor MER		- 87th Floor

Asbestos-Containing Surfacing And/Or Thermal System Insulation Materials Located In Four And Five World Trade Center

There is no asbestos-containing sprayed-on fireproofing in Four and Five World Trade Center.
A cementitious patch has been identified on a beam in the south wing of the southwest portion on the 5th floor in 5 WTC.
Thermal system insulation is present in the form of pipe saddles.

Asbestos-Containing Surfacing And/Or Thermal System Insulation Materials Located On The Concourse

There is no asbestos-containing sprayed-on fireproofing in the plenum of the Concourse.
Thermal system insulation material is present.
ACM

Asbestos-Containing Surfacing And/Or Thermal System Insulation Materials Located On The B1 Level And The Truckdock

Asbestos-containing sprayed-on fireproofing and thermal system insulation material is present.

Miscellaneous Asbestos-Containing Materials At The World Trade Center

Base building flooring throughout the facility is vinyl asbestos floor tile (VAT).

Asbestos-Containing Surfacing And Thermal System Insulation Materials Located In One World Trade Center - Exclusive Of Elevator Shafts

Full Floor Locations	Quadrant Location	Random Locations On Floor	Subgrades
Lobby Mezzanine 1st - 6th Floors: Core 6th Floor Catwalk 7 / 8 Floor MER 41 / 42 Floor MER 75 / 76 Floor MER 108 / 109 Floor MER		43 / 44 Floor Exhaust Duct 72nd Floor 82nd Floor Core Electric Closets On The 1st - 40th Floors Perimeter Electric Closet On The 30th Floors	B1 Level: Core, North/ West/East Quadrant, B2 Level: Old Locksmith And B6 Level

Asbestos-Containing Surfacing And Thermal System Insulation Materials Located In Two World Trade Center - Exclusive Of Elevator Shafts

Full Floor Locations	Random Locations On Floor	Quadrant Location
6th Floor Catwalk 10th - 13th Floors 41 / 42 Floor MER	Lobby Mezzanine 7 / 8 Floor MER 9th Floor 19th Floor 20th Floor 26th Floor 33rd Floor 71st Floor 75 / 76 Floor MER	S/W, 43rd Floor

Asbestos-Containing Surfacing And Thermal System Insulation Materials Located In Four And Five World Trade Center

There is no asbestos-containing sprayed-on fireproofing in Four and Five World Trade Center.
Thermal system insulation is present in the form of pipe saddles.

Asbestos-Containing Surfacing And Thermal System Insulation Materials Located On The Concourse

There is no asbestos-containing sprayed-on fireproofing in the plenum of the Concourse.
There is thermal system insulation material present.
ACM

Asbestos-Containing Surfacing And Thermal System Insulation Materials Located On The B1 Level And The Truckdock

Asbestos-containing sprayed-on fireproofing and thermal system insulation material is present.

Miscellaneous Asbestos-Containing Materials At The World Trade Center

Base building flooring throughout the facility is vinyl asbestos floor tile (VAT).

ACBM is located behind the convector units at the following locations:
1 WTC; 77, 79, 88, 101, 103 and 105.
2 WTC; 22, 24, 59, 72, 79, 81, 84, 86 and 87.

World Trade Center Elevator Shafts With Asbestos-Containing Insulation Material

One World Trade Center

Shafts	1 - 5:	Elevator Pit to EMR
	8 - 9:	Elevator Pit to EMR
	16 - 21:	Elevator Pit to 32nd Floor
	22 - 23:	Elevator Pit to EMR
	48:	Elevator Pit to EMR
	49:	Elevator Pit to 32nd Floor
	50:	Elevator Pit to 31st Floor
	24 - 29:	Elevator Pit to EMR
	30 - 35:	Elevator Pit to EMR
	36 - 41:	Elevator Pit to EMR
	42 - 47:	Elevator Pit to EMR
	51 - 56:	Elevator Pit to EMR
	57 - 62:	Elevator Pit to EMR
	63 - 68:	Elevator Pit to EMR
	69 - 74:	Elevator Pit to EMR

Two World Trade Center

Shafts	5 & 48:	Elevator Pit to EMR
	10 & 11:	Elevator Pit to EMR
	14 & 15:	Elevator Pit to EMR
	24 - 29:	Elevator Pit to EMR
	30 - 35:	Elevator Pit to EMR
	36 - 41:	Elevator Pit to EMR
	42 - 47:	Elevator Pit to EMR
	51 - 56:	Elevator Pit to EMR
	57 - 62:	Elevator Pit to EMR
	63 - 68:	Elevator Pit to EMR
	69 - 74:	Elevator Pit to EMR

There is no asbestos-containing insulation material in the J and K elevator cars in 1 and 2 WTC.

There is no asbestos-containing insulation material with the elevator shafts in 4 and 5 WTC.

THE PORT AUTHORITY OF NEW YORK & NEW JERSEY

MEMORANDUM

TO: Phil Taylor-Supervising Engineer.

FROM: Pete Negron

DATE: July 21, 1999

SUBJECT: **Elevator Shaft Asbestos Assessment.**

REFERENCE: **Attached E-Mail**

COPY TO: J. Amatuccio, D. Bobbitt, A. Burton, J. Castaldo, F. Riccardelli, L. Zucchi.

During the week of July 21, 1999, I inspected the elevator shafts to assess the condition of the fireproofing on the steel members.

The attached report includes the shaft number, floor and condition of fireproofing: intact or delaminated, and recommended action.

Floors not listed were inspected and found to be acceptable in that the fireproofing was intact.

In summary, of the 22 shafts inspected, shafts, which require full-scale abatement, are shafts 22/23A, 10B and 48B.

If you require further information regarding this report please contact me at 1.212.435.8364.

Pete Negron
Associate Environmental Analyst
Operations & Maintenance Management
World Trade Center

Attachment

WORLD TRADE CENTER
ELEVATOR SHAFTS ASBESTOS ASSESSMENT

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
25	1A	NO	YES	24 S.F.	SEAL EDGES
26	1A	NO	YES	12 S.F.	SEAL EDGES
27	1A	NO	YES	30 S.F.	SEAL EDGES
28	1A	NO	YES	12 S.F.	SEAL EDGES
29	1A	NO	YES	48 S.F.	SEAL EDGES
SPRAY-ON MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
9	2A	NO	YES	24 S.F.	SEAL EDGES
27	2A	NO	YES	4 S.F.	SEAL EDGES
28	2A	NO	YES	4 S.F.	SEAL EDGES
29	2A	NO	YES	4 S.F.	SEAL EDGES
30	2A	NO	YES	24 S.F.	SEAL EDGES
31	2A	NO	YES	24 S.F.	SEAL EDGES
34	2A	NO	YES	36 S.F.	SEAL EDGES
38	2A	NO	YES	6 S.F.	SEAL EDGES
SPRAY-ON MATERIAL					

2A

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
310	3A	NO	YES	72 S.F.	SEAL EDGES
5	3A	NO	YES	34 S F.	SEAL EDGES
8	3A	NO	YES	48 S.F.	SEAL EDGES
9	3A	NO	YES	48 S.F.	SEAL EDGES
16	3A	NO	YES	30 S.F	SEAL EDGES
17	3A	NO	YES	48 S F.	SEAL EDGES
18	3A	NO	YES	48 S.F.	SEAL EDGES
19	3A	NO	YES	72 S.F.	SEAL EDGES
28	3A	NO	YES	48 S.F.	SEAL EDGES
34	3A	NO	YES	72 S.F.	SEAL EDGES
40	3A	NO	YES	6 S F.	SEAL EDGES
SPRAYED-ON MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
ALL	4A	YES	NO	NONR	NONE
CEMENTITIOUS MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
ALL	5A	YES	NO	NONE	NONE
ALL	48A	YES	NO	NONE	NONE
CEMENTITIOS MATERIAL					

Note: Delamination is fireproofing whether sprayed or troweled no longer present on the steel members.

WORLD TRADE CENTER
ELEVATOR SHAFTS ASBESTOS ASSESSMENT

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
22	8A	NO	YES	72 S.F.	SEAL EDGES
33	8A	NO	YES	48 S.F.	SEAL EDGES
36	8A	NO	YES	4 S.F.	SEAL EDGES
38	8A	NO	YES	48 S.F.	SEAL EDGES
39	8A	NO	YES	48 S.F.	SEAL EDGES
SPRAY-ON MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
7	9A	NO	YES	2 S.F.	SEAL EDGES
13	9A	NO	YES	2 S.F.	SEAL EDGES
24	9A	NO	YES	3 S.F.	SEAL EDGES
31	9A	NO	YES	4 S.F.	SEAL EDGES
34	9A	NO	YES	6 S.F.	SEAL EDGES
36	9A	NO	YES	6 S.F.	SEAL EDGES
39	9A	NO	YES	48 S.F.	SEAL EDGES
41	9A	NO	YES	48 S.F.	SEAL EDGES
43	9A	NO	YES	48 S.F.	SEAL EDGES
SPRAYED-ON MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
9	16A	NO	YES	24 S.F.	SEAL EDGES
25	16A	NO	YES	18 S.F.	SEAL EDGES
26	16A	NO	YES	28 S.F.	SEAL EDGES
27	16A	NO	YES	48 S.F.	SEAL EDGES
28	16A	NO	YES	24 S.F.	SEAL EDGES
CEMENTITIUOS MATERIAL					

FLOORS	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
ALL	17A	YES	NO	NO	NONE

FLOORS	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
ALL	18A	X	NO	NONE	NONE

Note: Delamination is fireproofing whether sprayed or troweled no longer present on the steel members

WORLD TRADE CENTER
ELEVATOR SHAFTS ASBESTOS ASSESSMENT

FLOOR	SHAFT 1 WTC	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
8	19A	NO	YES	16 S.F.	SEAL EDGES
10	19A	NO	YES	24 S.F.	SEAL EDGES
11	19A	NO	YES	24 S.F.	SEAL EDGES
19	19A	NO	YES	48 S.F.	SEAL EDGES
25	19A	NO	YES	48 S.F.	SEAL EDGES
26	19A	NO	YES	48 S.F.	SEAL EDGES
28	19A	NO	YES	24 S.F.	SEAL EDGES
30	19A	NO	YES	24 S.F.	SEAL EDGES
32	19A	NO	YES	2 S.F.	SEAL EDGES
CEMENTITIOUS MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
8	20A	NO	YES	12 S.F.	SEAL EDGES
10	20A	NO	YES	3 S.F.	SEAL EDGES
22	20A	NO	YES	3 S.F.	SEAL EDGES
23	20A	NO	YES	3 S.F.	SEAL EDGES
25	20A	NO	YES	36 S.F.	SEAL EDGES
26	20A	NO	YES	34 S.F	SEAL EDGES
27	20A	NO	YES	26 S.F.	SEAL EDGES
28	20A	NO	YES	30 S.F.	SEAL EDGES
29	20A	NO	YES	28 S.F.	SEAL EDGES
SPRAYED-ON MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
310	21A	NO	YES	24 S.F.	SEAL EDGES
2	21A	NO	YES	24 S.F.	SEAL EDGES
3	21A	NO	YES	24 S.F.	SEAL EDGES
9	21A	NO	YES	24 S F.	SEAL EDGES
23	21A	NO	YES	24 S F.	SEAL EDGES
29	21A	NO	YES	48 S F.	SEAL EDGES
32	21A	NO	YES	6 S F	SEAL EDGES
SPRAYED-ON MATERIAL					

Note: Delamination is fireproofing whether sprayed or troweled no longer present on the steel members

WORLD TRADE CENTER
ELEVATOR SHAFTS ASBESTOS ASSESSMENT

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
3	22A	NO	YES	4 S.F.	SEAL EDGES
4	22A	NO	YES	4 S.F.	SEAL EDGES
5	22A	NO	YES	4 S.F.	SEAL EDGES
6	22A	NO	YES	4 S.F.	SEAL EDGES
7	22A	NO	YES	4 S.F.	SEAL EDGES
8	22A	NO	YES	4 S.F.	SEAL EDGES
9	22A	NO	YES	4 S.F.	SEAL EDGES
10	22A	NO	YES	4 S.F.	SEAL EDGES
11	22A	NO	YES	4 S F.	SEAL EDGES
12	22A	NO	YES	4 S F.	SEAL EDGES
13	22A	NO	YES	4 S.F.	SEAL EDGES
14	22A	NO	YES	6 S.F.	SEAL EDGES
15	22A	NO	YES	4 S F.	SEAL EDGES
16	22A	NO	YES	12 S.F.	SEAL EDGES
18	22A	NO	YES	6 S.F.	SEAL EDGES
19	22A	NO	YES	6 S.F.	SEAL EDGES
20	22A	NO	YES	6 S.F.	SEAL EDGES
21	22A	NO	YES	6 S.F.	SEAL EDGES
22	22A	NO	YES	6 S.F.	SEAL EDGES
23	22A	NO	YES	6 S.F.	SEAL EDGES
24	22A	NO	YES	6 S.F.	SEAL EDGES
25	22A	NO	YES	6 S.F.	SEAL EDGES
26	22A	NO	YES	8 S F.	SEAL EDGES
27	22A	NO	YES	6 S F	SEAL EDGES
28	22A	NO	YES	48 S F.	SEAL EDGES
29	22A	NO	YES	6 S.F.	SEAL EDGES
30	22A	NO	YES	6 S.F	SEAL EDGES
31	22A	NO	YES	6 S.F.	SEAL EDGES
32	22A	NO	YES	6 S.F.	SEAL EDGES
33	22A	NO	YES	6 S.F.	SEAL EDGES
34	22A	NO	YES	6 S.F	SEAL EDGES
35	22A	NO	YES	4 S F.	SEAL EDGES
36	22A	NO	YES	8 S F	SEAL EDGES
37	22A	NO	YES	6 S F.	SEAL EDGES
38	22A	NO	YES	6 S F	SEAL EDGES
39	22A	NO	YES	24 S F.	SEAL EDGES
40	22A	NO	YES	8 S F	SEAL EDGES
41	22A	NO	YES	8 S F	SEAL EDGES
42	22A	NO	YES	8 S F.	SEAL EDGES
43	22A	NO	YES	8 S F	SEAL EDGES
44	22A	NO	YES	8 S F.	SEAL EDGES
45	22A	NO	YES	8 S F.	SEAL EDGES
46	22A	NO	YES	8 S.F.	SEAL EDGES
47	22A	NO	YES	8 S.F.	SEAL EDGES
48	22A	NO	YES	2 S.F.	SEAL EDGES
49	22A	NO	YES	6 S F	SEAL EDGES
50	22A	NO	YES	2 S.F	SEAL EDGES
51	22A	NO	YES	4 S.F.	SEAL EDGES
52	22A	NO	YES	4 S.F.	SEAL EDGES
54	22A	NO	YES	4 S F.	SEAL EDGES
55	22A	NO	YES	2 S.F.	SEAL EDGES
56	22A	NO	YES	48 S.F	SEAL EDGES
58	22A	NO	YES	3 S.F	SEAL EDGES
62	22A	NO	YES	2 S.F.	SEAL EDGES
64	22A	NO	YES	2 S.F.	SEAL EDGES
67	22A	NO	YES	2 S F	SEAL EDGES

Note: Delamination is fireproofing whether sprayed or troweled no longer present on the steel members

WORLD TRADE CENTER
ELEVATOR SHAFTS ASBESTOS ASSESSMENT

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
70	22A	NO	YES	3 S.F.	SEAL EDGES
73	22A	NO	YES	2 S.F.	SEAL EDGES
78	22A	NO	YES	2 S.F.	SEAL EDGES
SPRAYED-ON MATERIAL			ABATEMENT OF SHAFT IS RECOMMENDED		

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
16	23A	NO	YES	2 S.F.	SEAL EDGES
17	23A	NO	YES	2 S.F.	SEAL EDGES
18	23A	NO	YES	2 S.F.	SEAL EDGES
19	23A	NO	YES	2 S.F.	SEAL EDGES
20	23A	NO	YES	2 S.F.	SEAL EDGES
21	23A	NO	YES	2 S.F.	SEAL EDGES
22	23A	NO	YES	2 S.F.	SEAL EDGES
23	23A	NO	YES	2 S.F.	SEAL EDGES
24	23A	NO	YES	2 S.F.	SEAL EDGES
25	23A	NO	YES	2 S.F.	SEAL EDGES
26	23A	NO	YES	2 S.F.	SEAL EDGES
27	23A	NO	YES	2 S.F.	SEAL EDGES
28	23A	NO	YES	2 S.F.	SEAL EDGES
29	23A	NO	YES	2 S.F.	SEAL EDGES
30	23A	NO	YES	2 S.F.	SEAL EDGES
31	23A	NO	YES	2 S.F.	SEAL EDGES
32	23A	NO	YES	2 S.F.	SEAL EDGES
33	23A	NO	YES	2 S.F.	SEAL EDGES
34	23A	NO	YES	2 S.F.	SEAL EDGES
35	23A	NO	YES	2 S.F.	SEAL EDGES
36	23A	NO	YES	2 S.F.	SEAL EDGES
37	23A	NO	YES	2 S.F.	SEAL EDGES
73	23A	NO	YES	1 S.F.	SEAL EDGES
SPRAYED-ON MATERIAL			ABATEMENT OF SHAFT IS RECOMMENDED		

Note: Delamination is fireproofing whether sprayed or troweled no longer present on the steel members.

WORLD TRADE CENTER
ELEVATOR SHAFTS ASBESTOS ASSESSMENT

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
3	10B	NO	YES	6 S.F.	SEAL EDGES
4	10B	NO	YES	6 S.F.	SEAL EDGES
7	10B	NO	YES	8 S.F.	SEAL EDGES
12	10B	NO	YES	1 S.F.	SEAL EDGES
15	10B	NO	YES	2 S.F.	SEAL EDGES
19	10B	NO	YES	20 S.F	SEAL EDGES
20	10B	NO	YES	15 S.F.	SEAL EDGES
21	10B	NO	YES	26 S.F.	SEAL EDGES
22	10B	NO	YES	28 S.F.	SEAL EDGES
23	10B	NO	YES	15 S.F.	SEAL EDGES
25	10B	NO	YES	48 S.F.	SEAL EDGES
28	10B	NO	YES	4 S.F.	SEAL EDGES
33	10B	NO	YES	2 S.F.	SEAL EDGES
31	10B	NO	YES	2 S.F.	SEAL EDGES
34	10B	NO	YES	48 S.F.	SEAL EDGES
35	10B	NO	YES	48 S.F.	SEAL EDGES
36	10B	NO	YES	34 S.F.	SEAL EDGES
37	10B	NO	YES	24 S.F.	SEAL EDGES
39	10B	NO	YES	48 S.F.	SEAL EDGES
40	10B	NO	YES	48 S.F.	SEAL EDGES

SPRAYED-ON MATERIAL — ABATEMENT OF SHAFT IS RECOMMENDED

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
5	11B	NO	YES	1 S.F.	SEAL EDGES
12	11B	NO	YES	1 S.F.	SEAL EDGES
19	11B	NO	YES	2 S.F.	SEAL EDGES
26	11B	NO	YES	2 S.F.	SEAL EDGES
31	11B	NO	YES	48 S.F.	SEAL EDGES
33	11B	NO	YES	2 S.F	SEAL EDGES
40	11B	NO	YES	2 S.F	SEAL EDGES

SPRAYED-ON MATERIAL

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
ALL	9B	YES	NO	NONE	NONE
ALL	48B	NO	YES	***	ABATEMENT

48B SHAFT-SPRAYED-ON FIREPROOFING

*** 1' - FOOT STRIP ALONG LENGTH OF COLUMN MISSING

Note: Delamination is fireproofing whether sprayed or troweled no longer present on the steel members

WORLD TRADE CENTER
ELEVATOR SHAFTS ASBESTOS ASSESSMENT

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
3	14B	NO	YES	2 S.F.	SEAL EDGES
4	14B	NO	YES	2 S.F.	SEAL EDGES
8	14B	NO	YES	1 S.F.	SEAL EDGES
9	14B	NO	YES	1 S.F.	SEAL EDGES
10	14B	NO	YES	1 S.F.	SEAL EDGES
11	14B	NO	YES	1 S.F.	SEAL EDGES
12	14B	NO	YES	1 S.F.	SEAL EDGES
13	14B	NO	YES	1 S.F.	SEAL EDGES
14	14B	NO	YES	1 S.F.	SEAL EDGES
15	14B	NO	YES	1 S.F.	SEAL EDGES
16	14B	NO	YES	1 S.F.	SEAL EDGES
17	14B	NO	YES	1 S.F.	SEAL EDGES
18	14B	NO	YES	1 S.F.	SEAL EDGES
23	14B	NO	YES	1 S.F.	SEAL EDGES
24	14B	NO	YES	1 S.F.	SEAL EDGES
25	14B	NO	YES	1 S.F.	SEAL EDGES
26	14B	NO	YES	1 S.F.	SEAL EDGES
27	14B	NO	YES	1 S.F.	SEAL EDGES
28	14B	NO	YES	1 S.F.	SEAL EDGES
SPRAYED-ON MATERIAL					

FLOOR	SHAFT	FIREPROOFING INTACT	DELAMINATION	QUANTITY DELAMINATED	RECOMMENDATION
310	15B	NO	YES	4 S.F.	SEAL EDGES
3	15B	NO	YES	2 S.F.	SEAL EDGES
4	15B	NO	YES	4 S.F.	SEAL EDGES
22	15B	NO	YES	1 S.F.	SEAL EDGES
25	15B	NO	YES	8 S.F.	SEAL EDGES
SPRAYED-ON MATERIAL					

Note: Delamination is fireproofing whether sprayed or troweled no longer present on the steel members.

THE PORT AUTHORITY OF NY & NJ

TWO WORLD TRADE CENTER, 37TH FLOOR
NEW YORK, NY 10048

(212) 435-7000
(201) 961-6600

October 18, 2000

R. W. Crandlemere & Associates
549 Columbian Street
Suite 305
Weymouth, MA 02190

RE: **ASBESTOS DUE DILIGENCE: INFORMATION REQUEST.**

Dear Mr. Crandlemere:

Please find attached the responses to your October 12, 2000 fax wherein you requested that the available asbestos information be broken down into seven areas. In addition, responses to your general information requests are also provided.

Request: **Total remaining and total removed ACM, broken down by material types and locations, within the designated areas as much as practical (e.g. by floor number or other description; such as within pipe chase or the elevator shafts).**

The attached breakdowns for 1 WTC, 2 WTC, 4 WTC, 5 WTC, MERs, Subgrade, and Concourse disclose the estimated amounts of asbestos-containing sprayed-on fireproofing and thermal system insulation material present. Drawings identifying these asbestos locations by sample number are on file in my office. Attachments disclosing the amounts of vinyl asbestos floor tiles present as of April, 2000 are also included. These estimates were provided by the Port Authority's Engineering Department, Asbestos Litigation Task Force, and the World Trade Department.

Asbestos-containing roofing material was removed from the MER set-backs in 1 and 2 World Trade Center, and the roofs of 4 and 5 World Trade Center. The roofs of 1 and 2 World Trade Center were not sampled.

Request: **The abatement costs for work performed and anticipated future abatement costs for each type of remaining known ACM.**

From 1986 to 1999, a total thirty one (31) contracts were bid, and a total of $58.2 million dollars was spent in abatement projects. The Engineering Department estimates the cost for vinyl asbestos floor tile removal to be between $5 - $6 per square foot, sprayed-on removal to be between $20 - $25 per square foot, and thermal system insulation to be $15 per linear foot (outer diameter dependant).

As of September, 2000, a total of 2,184,038 million square feet of sprayed-on fireproofing, and 3,500,000 million square feet of vinyl asbestos floor tile was removed. According to PA records, a total of seven million square feet of vinyl asbestos floor tiles were installed in the World Trade Center.

Request: **Materials determined not to be ACM (e.g. spline ceilings, hung ceilings, wallboard, wallboard joint compound, etc., as well as areas of sprayed-on fireproofing determined not to be ACM).**

Sampling of the building materials noted above did not disclose the presence of asbestos.

Request: **Any materials that are assumed to be ACM (such as fire doors) with an estimate, if possible, of the amounts of each material.**

Our presumption as to the types of asbestos-containing building materials within the World Trade Center did not include fire doors. Based upon sample data, asbestos containing building materials appear to be limited to sprayed-on fireproofing, thermal system insulation, and floor tiles and mastic.

Request: **Asbestos litigation status.**

Your information request has been forwarded to the Port Authority's Law Department. We will notify you accordingly.

The following information is in response to your fax dated Wednesday, October 18th.

Request: PCB-containing Hydraulic Fluid.

The hydraulic fluid (hydraulic oil # 32 AW) leaking from elevator FE-5, located on the B4 Level of 1 World Trade Center does not contain PCB. I have a copy of the Material Safety Data Sheet from the distributor; Consumers Oil, 515 South First Avenue, Mt. Vernon, N.Y.. Hydraulic elevator FE - 6 in 2 World Trade Center also uses hydraulic oil # 32 AW.

Relating to the trash compactors, please note that the hydraulic fluid is ordered through the Port Authority Stockroom from an approved list of chemical products established by the Inspection & Safety Division. The hydraulic fluid used for the trash compactors is either mineral or vegetable based. Both are non-PCB products.

Request: Additional Information Regarding Radio-Frequency Testing.

I do not have a copy of, nor do I have knowledge of the March ,1999 report prepared by Denny & Associates recommending additional RF exposure monitoring. All radio-frequency documents are available for your review in the Document Room.

Please contact me at (212) 435-8507 should you have any questions or require additional information.

Phil Taylor
World Trade Operations &
Maintenance Management

Cc: J. Connors, A. Reiss, L. Zucchi

1, 2, 4, and 5 WTC

Mechanical Equipment Rooms

1 WTC:

7th / 8th Floor MER	25,000 sqft of sprayed-on / TSI present but quantity unknown
41st / 42nd Floor MER	25,000 sqft of sprayed-on / " " " " "
75th / 76th Floor MER	25,000 sqft of sprayed-on / " " " " "
108th / 109th Floor MER	25,000 sqft of sprayed-on / " " " " "
TOTAL:	100,000 sqft of sprayed-on / TSI quantity unknown*

* Non-fiberglass wrapped piping components, such as elbows, fittings, and flanges contain asbestos.

2 WTC:

41st / 42nd Floor MER	25,000 sqft of sprayed-on / TSI present but quantity unknown
TOTAL:	25,000 sqft of sprayed-on / TSI quantity unknown*

* Non-fiberglass wrapped piping components, such as elbows, fittings, and flanges contain asbestos.

4 WTC:

Non-ACM

5 WTC:

Non-ACM

1, 2, 4, and 5 WTC

SUBGRADES and TRUCKDOCK

Subgrades -

1 WTC:

B1 Level – Core, and N/E Quadrant	5,000 sqft / No TSI
B6 Level – Entire Level	40,000 sqft / No TSI
TOTAL:	45,000 sqft / No TSI

2, 4, and 5 WTC: No ACM

Truckdock -

Main Truckdock 50,000 sqft

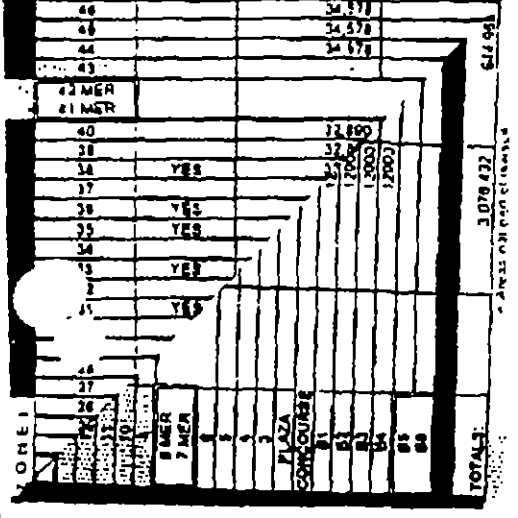
1, 2, 4, and 5 WORLD TRADE CENTER

VINYL ASBESTOS FLOOR TILES

Amount Remaining in 1 WTC:	710,677 sqft
Amount Remaining in 2 WTC:	1,734,032 sqft
Amount Remaining in 4 WTC:	241,000 sqft
Amount Remaining in 5 WTC:	167,515 sqft

VAT ABATEMENT STATUS DIAGRAM

TWTC FLOORS	ALTF Sampled	TOTAL VAT Installation area	ABATED Sq Ft VAT IN CLAIM	CONTRACT NUMBERS	JOB NUMBERS IN CLAIM	ABATED Sq Ft VAT NOT IN CLAIM	JOB NUMBERS NOT IN CLAIM	REMAINING Sq Ft VAT ON FLOOR	TWTC FLOORS
110									110
108 MER 108 MER									108 MER 108 MER
107		35,900						1,918	107
106		35,900						34,078	106
105		35,900		115 224	115 283			34,424	105
104		35,900		115 224	115 283	2,020	910	30,527	104
103		35,900		115 224	115 283			34,403	103
102		35,900		115 224	115 283	500		34,487	102
101	YES	35,487				35,487	958	-	101
100		-		115 295		2,801	115 196	-2,801	100
99		35,900	10,357	115 289	189	1000,3300	874 628	31,800	99
98		35,900						35,900	98
97		35,900	7,000	115 510	976	2,000	973	-	97
96	YES	35,900	5,000	115 510	949	3,100	997	3,881	96
95		35,900						35,900	95
94		35,900						-	94
93		35,900						36,849	93
92	YES	34,846	36,846	115 295	118 153			-	92
91		35,900						30,742	91
90	YES	30,742	30,742	115 224	118 8484			-	90
89		35,900	35,900	115 295	118 035			-	89
88		35,900	35,900	115 295	118 072			-	88
87		35,900	35,900	115 224 295	115 748 141			-	87
86		35,900	35,900	115 295	118 018			-	86
85		35,900						35,908	85
84	YES	35,900	34 414	115 224	258			1,488	84
83	YES	35,900		115 295		19,700	377	15,882	83
82		35,900						32,349	82
81		35,900						33,813	81
80		35,900						32,887	80
79		35,900						23,821	79
78	YES	35,900	11,000 (20,300)	116 510 (115 295)	213 (169)			20,888	78
77		35,900						24,897	77
76 MER 75 MER		3,000	2,500	115 295 802 071	118 112 118 281			500	76 MER 75 MER
74		34,578				34,578	724	-	74
73		34,578						34,219	73
72		34,578						34,219	72
71		34,578						35,195	71
70		34,578						35,195	70
69		34,578						34,288	69
68		34,578						34,288	68
67		34,578						34,288	67
66		34,578						31,849	66
65		34,578						34,298	65
64		34,578						34,288	64
63		34,578						33,904	63
62		34,578						33,504	62
61		34,578	3,700	115 295	[illegible]			27,008	61
60		34,578						34,578	60
59		34,578						33,381	59
58	YES	34,578	33,381	115 510	945			1,197	58
57	YES	34,578	32,561	115 510	209			2,017	57
56		34,578						32,561	56
55	YES	34,578	14,000	115 224	257			20,170	55
54		34,578	1,080	115 295	118 020			31,370	54
53		34,578						33,050	53
52		34,578						33,050	52
51		34,578						33,050	51
50		34,578				4,385	308	19,342	50
49		34,578							
48	YES	24,000	24,000						
47	YES	24,000	24,000						
46		34,578							
45		34,578							
44		34,578							
43		-							
42 MER 41 MER									
40		32,890							
39		32,8							
38	YES	3	12000						
37			12000						
36	YES								
35	YES								
34									
33	YES								
32									
31	YES								



ATTACHMENT 8

Crandlemere and Associates Roof Mounted Transmission Devices
Document Review & Evaluation

R. W. CRANDLEMERE & ASSOCIATES, INC.
PROTECTING BUSINESS AND THE ENVIRONMENT

ROOF-MOUNTED TRANSMISSION DEVICES

DOCUMENT REVIEW AND EVALUATION

TWO WORLD TRADE CENTER

NEW YORK CITY, NY 10081

Project #000095

Merritt & Harris, Inc. #20-251E

User:

Merritt & Harris, Inc.
Attn: Mr. Robert G. Weiland, V. P.
110 East 42nd Street, 12th Floor
New York City, NY 10017-5685

Date Issued: November 7, 2000

549 Columbian Street, Suite 305, Weymouth, MA 02190 Tel. (781) 340-6161 Fax (781) 340-9191

The review and evaluation of documents provided regarding the roof mounted transmission devices described herein was conducted by the undersigned, of R. W. Crandlemere & Associates, Inc. (CRANDLEMERE & ASSOCIATES). CRANDLEMERE & ASSOCIATES assessment consisted solely of the activities described in the Introduction of this report. The assessment was conducted in accordance with the Scope of Work described in our Proposal No. 00-090. It is subject to the Limitations and Service Constraints submitted in Appendix A of the ASTM Phase I Environmental Site Assessment provided as part of this Project. See Appendix F of that report for ASTM definitions of words in italics in this report.

Report Prepared by:

R. Wayne Crandlemere
President

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Appendix B Photographs

1.0 INTRODUCTION

1.1 Background

R. W. Crandlemere & Associates, Inc. (CRANDLEMERE & ASSOCIATES) was retained by Merritt & Harris, Inc. (the *user*) to conduct an ASTM E1527-97 Phase I *Environmental Site Assessment* (ESA) of One, Two, Four and Five World Trade Center, located in the Borough of Manhattan, New York City, New York, 10081.

It is our understanding that Merritt & Harris, Inc. is providing this information in conjunction with, and as part of, a larger assessment of the *property* and has named The Port Authority of New York and New Jersey as an *additional user* as defined by the ASTM Standard E1527-97 Section 3.3.39. As an *additional user*, The Port Authority of New York and New Jersey may rely on the information presented in this report.

This report presents CRANDLEMERE & ASSOCIATES' professional opinion, and no warranty, expressed or implied, is made. The Port Authority of New York and New Jersey has the right to reproduce in full and provide copies of this report to interested parties. All reports, both verbal and written, are for the benefit of The Port Authority of New York and New Jersey and its' agents, employees, participates, and assigns.

On September 26, 27, 28 and 29 and October 10 and 11, 2000 Mr. R. Wayne Crandlemere of CRANDLEMERE & ASSOCIATES conducted a *Site visit* to identify *recognized environmental conditions* at the Site. In addition, CRANDLEMERE & ASSOCIATES' assessment included reconnaissance of adjacent properties, background research, and review of available local, state and federal regulatory records regarding the presence of petroleum products or hazardous materials at or in the vicinity of the Site.

The results of our work regarding the ASTM Standard for a Phase I Environmental Site Assessment of the Site is provided in a separate Phase I ESA report.

Discussions related to the facility programs that deal with asbestos-containing materials (ACM) and the electro-magnetic radiation related to the antenna tower on One World Trade Center are included in the condition assessment reports related to each building (One, Two, Four & Five World Trade Center), the Retail Mall and Plaza, Central Services and Sub-grade areas.

This report is a discussion of the information specific to Two World Trade Center, the South Tower related only to the roof-mounted transmission devices located on One World Trade Center, the North Tower, and their potential impact on workers and/or visitors at Two World trade Center, the South Tower. See the other specific reports for information specific to those buildings and facility areas.

2.0 REVIEW OF DOCUMENTS

There is a 360 foot tall antenna mast rising from the top of the One World Trade Center Tower extending to a height of 1,728 feet above ground level. The tower and roof have antennas reported to service 9 television stations and 4 FM radio stations, and has an additional 83 wireless communication antennas. As part of this assessment, CRANDLEMERE & ASSOCIATES reviewed the following documents provided by the owner:

- "An Evaluation of the Radiofrequency Environment at the World Trade Center North Tower", September 29, 1997, prepared by Richard Tell Associates, Inc., Las Vegas, NV;
- "Radiation Safety Survey of World Trade Department Ion Mobility Spectrometer Instrument – One World Trade Center" Memorandum March 11, 1998, prepared by Paul W. Mitchell, Environmental and Occupational Health Division, Risk Management, The Port Authority of New York & New Jersey;
- "Antenna Structure Registration", issued 3/23/98, Registration #1002506, U.S. of America, Federal Communications Commission;
- "RF Safety Awareness for World Trade Center Workers, A Presentation at the World Trade Center", dated February 1999 (2/3/99) presented by Richard Tell Associates, Inc. of Las Vegas, NV;
- "Engineering Report Electromagnetic Field Strength Survey at the South Tower of the World Trade Center", March 17, 1999, prepared by Denny & Associates, P.C., Washington, DC;
- "Radiation Safety Survey – One World Trade Center", Memorandum July 26, 1999, prepared by Paul W. Mitchell, Environmental and Occupational Health Division, Risk Management, The Port Authority of New York & New Jersey (copy attached to CRANDLEMERE & ASSOCIATES' report as Appendix A);
- "A Reevaluation of Radiofrequency Fields on the World Trade Center North Tower", September 15, 2999, Revised March 21, 2000, prepared by Richard Tell Associates, Las Vegas, NV;
- "Radiation Safety Survey – One World Trade Center", January 27, 2000, prepared by Paul W. Mitchell, Environmental and Occupational Health Division, Risk Management, The Port Authority of New York & New Jersey;
- "An Investigation of RF Safety Considerations on the World Trade Center Antenna Mast Relevant to Work to Install a New Digital Television Antenna," May 12, 2000, prepared by Richard Tell Associates, Las Vegas, NV; and

- "Radiation Safety Survey – One World Trade Center", July 28, 2000, prepared by Paul W. Mitchell, Environmental and Occupational Health Division, Risk Management, The Port Authority of New York & New Jersey.

The May 12, 2000 Richard Tell Associates (Tell) report indicates "controls are in place to restrict access to the rooftop to personnel who have been trained in radio frequency (RF) safety matters or who are escorted by someone who has been so trained." On the date of CRANDLEMERE & ASSOCIATES roof visit, the access to the roof of One World Trade Center was so restricted and Mr. Crandlemere was so escorted. The Tell report states "special procedures are in place for tower maintenance activities to prevent exposure to RF fields that would exceed the occupational/controlled maximum permissible exposure) MPE limit." Tell's work, as described in their May 12, 2000 report, as well as in their previous work, included "RF field measurements...taken in...designated work region(s) and provides insights and recommendations that will assist in complying with the FCC rules." Appendix C of the May 12, 2000 report includes a Roof Map of RF Fields which indicates only 0.72% (195 square feet) of the roof area potentially exceed FCC RF MPE limits for occupational/ controlled exposures on the roof of the One World Trade Center, the North Tower. They further report "It is important to emphasize that these calculated results are based upon an assumption that all wireless telecommunications antennas on the roof are simultaneously active; that is likely not the case most of the time."

Work performed by Denny & Associates as reported March 17, 1999, indicates that the RF levels measured on the outside observation deck of Two World Trade Center, the South Tower (Photo #1), exceed "the maximum permissible level for general population/ uncontrolled exposure...for certain modes of auxiliary broadcast antenna use at WTC1 (North Tower)." They conclude that "The basic finding of this survey is that only the low band VHF television stations can operate using their auxiliary antennas without causing overexposure of the outdoor observation deck walkway at WTC2." That report indicates "Further investigation of the WTC2 exposure levels is warranted." "Since the initial objective of identifying procedures by which the broadcast stations at WTC1 can employ either their main or auxiliary antennas without exceeding the FCC MPE for general population/uncontrolled environments on the observation deck walkway at WTC2 has not been achieved...additional studies will permit broadcasters at WTC2 to move closer and ultimately fulfill their objectives of assuring compliance with the FCC rules."

3.0 MAJOR FINDINGS AND CONCLUSIONS

Based upon the information reviewed and summarized above, it appears that operational guidelines are currently in place to provide protection for trained workers and trained or escorted visitors to the roof of One World Trade Center, the North Tower, meeting the requirements of FCC MPE limits for occupational/controlled exposures. However, the 1999 Denny & Associates report indicates that under certain conditions the broadcasting at One World Trade Center, North Tower, creates RF exposures on the Two World Trade Center, South Tower, roof-top outdoor observation deck walkway that exceed the FCC MPE limits for general population/uncontrolled exposure. They recommended additional investigation. Based upon these reports, CRANDLEMERE & ASSOCIATES also recommends additional investigation of the RF exposure levels on the roof-top outdoor observation deck walkway on Two World Trade Center, the South Tower, with the intent of identifying procedures under which broadcasts at One World Trade Center, the North Tower, do not create RF exposures exceeding FCC Rules on the Two World Trade Center, South Tower, observation deck.

APPENDIX A

Denny & Associates, P.C.
Consul ting Engineers
Washington, D.C.

MARCH 17, 1999

ENGINEERING REPORT
ELECTROMAGNETIC FIELD STRENGTH SURVEY
AT THE SOUTH TOWER OF THE
WORLD TRADE CENTER

EXECUTIVE SUMMARY

Radio-frequency radiation surveys were conducted in December 1998 and January 1999 on the outdoor observation deck walkway of WTC2 (south tower). Previous surveys identified an area on the outdoor observation deck walkway at WTC2 where the maximum permissible level for general population/uncontrolled exposure is exceeded for certain modes of auxiliary broadcast antenna use at WTC1 (north tower). The previous exposure data were obtained with more than one broadcast station on the air, so it was not possible to analyze the aggregate exposure data to determine each broadcast station's individual contribution to the overall exposure level present in the area of concern.

The December measurements were made to identify those television stations able to use their auxiliary antennas at WTC1 without causing overexposure on the outdoor observation deck at WTC2. The basic finding of this survey is that only the low band VHF television stations can

operate using their auxiliary antennas without causing overexposure of the outdoor observation deck walkway at WTC2.

The January measurements were made with one station on the air at a time and individual station exposure data were obtained for each station using its main antenna. For those stations with an auxiliary antenna at WTC1, individual station exposure data also were obtained for that station with its auxiliary antenna in use. The January survey was designed to provide individual exposure data for each station and each mode of station operation. Based on all available information, contributions to the overall RF exposure environment at WTC2 from nonbroadcast sources in the area were expected to be small enough to be ignored and any bias statistically eliminated. However, in the final analysis, contributions from other nonbroadcast sources in the area proved to be too great to be ignored, and the individual broadcast station exposure data was biased by the contribution from nearby nonbroadcast sources. Because of the contributions from nonbroadcast sources, analysis of the January exposure data could not produce the desired result of determining the individual broadcast station contributions to the overall exposure present on WTC2.

Unfortunately, additional surveys will be required to accurately determine the individual broadcast station contributions to the overall exposure present on the outdoor observation deck walkway at WTC2. The next survey to be undertaken should duplicate the December 1998 measurements using new, more accurate instrumentation developed especially for characterizing general population/uncontrolled exposures. Measurements of this type can easily be made with minimal disruption, and the increased accuracy of the instrumentation may allow a conclusion of a slightly less than maximum exposure at WTC2 rather than the present conclusion of a slight overexposure.

If the new instrumentation continues to indicate a slight overexposure on the north side of the outdoor observation deck walkway at WTC2, then the next step will be to define and undertake a survey using instrumentation that will allow the WTC2 exposure to be characterized completely, fully identifying all contributors to the RF energy incident upon the walkway as individual broadcast station, cellular, PCS, paging, community repeater, and so forth. As no off-the-shelf instrumentation is available for this specialized purpose, a measurement system needs to be assembled and tested before this series of measurements can be made.

INTRODUCTION

The electromagnetic field strength surveys described in this report were undertaken on behalf of the television (TV) stations and FM radio stations operating at the World Trade Center as the second report to address exposure levels on the observation deck of the south tower of the World Trade Center (WTC2) from broadcast operations primarily located on the north tower of the World Trade Center (WTC1).[1] A low power television (LPTV) station is located on WTC2, but, as has been previously examined, the LPTV station contributes little to the radiofrequency radiation (RFR) exposure environment at WTC2. The FM and TV stations operating at WTC1 are identified in Figure 1 of this report.

1 The geographic coordinates for the WTC1 site are 40° 42′ 43″ North Latitude, 74° 00′ 49″ West Longitude referenced to the 1927 North American Datum (NAD 27).

BACKGROUND

There are two modes of operation for the broadcast stations located at WTC1: the normal mode and the auxiliary mode. In the normal mode of operation at WTC1, the TV and FM stations operate with their main antennas. In the auxiliary mode of operation, the FM stations operate with their main antennas, all of the VHF TV stations except WCBS-TV operate with their auxiliary antennas, and the UHF TV stations are off the air. WCBS-TV is the only VHF TV station that does not have an auxiliary antenna at WTC1. The WCBS-TV auxiliary antenna is located at the Empire State Building, 4.7 kilometers along a bearing of 30 degrees True from WTC1, and, accordingly, the WCBS-TV transmitter at WTC1 is shut down during auxiliary operation.

The need for additional exposure surveys at the World Trade Center was identified in January 1998 during the preparation of the license renewal applications for the FM stations located at WTC1. The FM licensees reviewed the RFR exposure issues related to their operations in light of the new Federal Communications Commission (FCC) Rules establishing new maximum permissible exposure (MPE) levels for human exposure to RFR

that were adopted in 1996 and implemented on October 15, 1997. Two major areas of concern were identified as a result of that review. One area of concern relates to the exposure levels of the roof of WTC1 and is the subject of a separate report.

The other area of concern is related to the exposure of visitors to the indoor observation area and the outdoor observation deck walkway at WTC2. This concern was partially addressed in the June 18, 1998, Denny & Associates, P.C. report which indicated that measured exposure levels within the indoor observation area and the outdoor observation deck walkway were found to be within the FCC MPE levels for general population/uncontrolled exposure for the normal mode of broadcast station operation, but measurements in an area of the outdoor observation deck walkway exceeded the FCC MPE Level for general population/uncontrolled exposure when the broadcast stations were operating in the auxiliary mode. The measurements made in support of this report were aimed at identifying the individual contributions of broadcast stations to the overall exposure levels on the observation deck walkway in order to mitigate exposure on the walkway during the auxiliary mode of operation.

SUMMARY OF FINDINGS

Two additional measurement programs were undertaken to develop procedures for reducing the exposure levels on the observation deck walkway during the auxiliary mode of operation. The first series of measurements made on December 17 and 18, 1998, measured exposure levels with different groups of television stations operating into their auxiliary antennas, while the remaining stations continued to employ their main antennas. The data from these measurements, which are tabulated in Figure 2 of this report, indicate that the exposure on a small portion of the north observation deck walkway, identified as point 2A in Figure 5 of this report, exceeds the FCC MPE for general population/uncontrolled exposure when some of the high-band VHF stations, including WABC-TV, WWOR-TV and WNET, employ their auxiliary antennas.

The December 1998 measurements were made using a conformal electric field probe that yields exposure level data as a percentage of exposure. The exposure levels measured using the occupational/controlled exposure electric field probe were multiplied by a factor of five to re-reference

the measured exposure levels to the MPE for general population/uncontrolled exposure.

Due to the limited sensitivity of the occupational/controlled exposure conformal electric field probe and the desire for greater resolution in the exposure data, a second measurement program was undertaken. The objective of the second course of measurements was to determine individually the exposure from each television station and, as a whole, the FM stations for both the normal and auxiliary modes of operation. To achieve this, all of the broadcast stations that operate from WTC1 and WTC2 went off the air on the morning of January 5, 1999. Exposure measurements were then made on the northern portion of the observation deck walkway with only one broadcast station at a time in operation. Numerous other paging, mobile radio and microwave facilities, over which the surveyors had no control, continued to operate from WTC1 and WTC2 while the individual broadcast station measurements were being made.

The recorded measurement data, tabulated in Figure 3 of this report, suggests higher than predicted exposure levels for most of the broadcast stations. When compared to the data collected in December 1998,

the summation of the individual station exposure levels measured in January 1999 yields total exposures far in excess of the December 1998 values. One possible explanation is the presence of high background exposure levels from nonbroadcast sources that could not be shut down during the survey. An exposure measurement was made at measurement locations 1, 1A, 1B, 2, 2A, 2B, and 3 as shown in Figure 5 with all of the broadcast stations off the air. The measured background exposure ranges from 13 to 30 percent of the MPE for general population/uncontrolled exposure over the seven points measured on the walkway. Further, complicating the presence of a high background exposure levels was the continuously varying level of the background exposure. Subtracting the measured background exposure at each point from the each station's measured level sometimes yields exposure levels less than zero. This is a clear indication that the background exposure was changing during the course of the measurements.

MEASUREMENT METHODOLOGY

The December 1998 broadband measurements were made using a Narda, model 8718, electromagnetic survey meter and a Narda, model 8722B,

occupational/controlled exposure conformal electric field probe. The survey meter and probes were calibrated by the manufacturer as a system in February 1998. The individual station measurements made in January 1999 were made with two virtually identical survey instruments consisting of a Narda, model 8718, survey meter and a Narda, model 8761, broadband electric field probe. The additional Narda survey meter and probe were last calibrated as a system on June 3, 1998. Prior to making formal measurements, both survey meters were compared and found to be in reasonable agreement.

All field strength measurements were made at distances far enough removed from the sources being measured to assume the existence of uniform plane wave conditions. Accordingly, no magnetic field strength measurements were deemed necessary to accurately define exposure.

To facilitate the making of average whole body exposure measurements, the survey meters were configured to make one measurement per second for a period of thirty seconds. At the end of the measurement period, the survey meters calculated the average of the thirty measurement values and stored the average measurement values in its internal memory for

later analysis. The survey meter was initialized to display and record measurement data in units of percent of the FCC MPE for occupational/controlled exposure for the 8722B probe and in units of volts squared per meter squared (V^2/m^2) for the 8761 probe.

Average whole body exposure measurements were made at each location by raising the electric field probe to head height, approximately two meters above ground level, initializing the measurement sequence, and then slowly lowering the probe to knee height, approximately one-half meter above ground level. The duration of the probe lowering motion coincided with the survey meter measurement period.

DISCUSSION OF FINDINGS

December 1998 Measurements

As discussed earlier, the purpose of the December 1998 measurements was to determine exposure levels on the observation deck walkway by measuring exposure levels while individual television stations or pairs of television stations used their auxiliary antennas. While the measurements were being made, the other television and FM broadcast stations at WTC1 remained in their normal operating mode. Figure 2 of this

report is a tabulation of measured exposure data for the nine points measured during the survey. The location of each point specified in the tabulation of Figure 2 is identified in the diagram of Figure 5 of this report.

Due to the broad range of frequencies in use by the multiple broadcast stations at WTC1, exposure measurements had to be made employing a survey probe that conforms to the FCC exposure guideline. However, the only probe available at the time of the measurements was a probe that conforms to the MPE for occupational/controlled exposure. Since the environment on the observation deck walkway is classified based on the more restrictive MPE for general population/uncontrolled exposure, the measurement data had to be re-referenced to the more restrictive MPE in order to obtain meaningful results for the general population/uncontrolled environment at WTC2. At the broadcast frequencies in use at WTC1, the FCC MPEs for general population/uncontrolled exposure are five times more restrictive than the FCC MPE for occupational/controlled exposure. Thus, the second tabulation included in Figure 2 of this report re-references the occupational/controlled exposure measurements into percentages relative to the MPE for general population/uncontrolled environments.

With the exception of one of the points under two operating conditions, exposure levels at all of the measured locations comply with the FCC MPE for general population/uncontrolled exposure. When WABC-TV employs its auxiliary antenna and all other stations are in their normal operating mode, the exposure at point 2A is 111.85 percent of the FCC MPE for general population/uncontrolled exposure. The exposure at the same point is 113.00 percent of the FCC MPE for general population/uncontrolled exposure when WWOR-TV and WNET both switch to their auxiliary antennas. Point 2A corresponds to the location identified in the June 18, 1999, WTC2 report where exposure exceeded the MPE for general population/uncontrolled environments when stations were operating in the auxiliary mode. The auxiliary antennas for WABC-TV, WWOR-TV, and WNET are located relatively low on the mast at WTC1. Additionally, WABC-TV, WWOR-TV, and WNET are all high-band VHF stations which employ higher ERPs than the low-band VHF television stations located on WTC1. It is the combination of the WABC-TV, WWOR-TV, and WNET relatively low auxiliary antenna height and higher ERP that results in higher exposure levels at WTC2 for these stations. However, the exposure levels for these stations do not significantly exceed the MPE for general

population/uncontrolled exposure. This, coupled with the possibility that any error in the occupational/controlled measurement data was amplified when multiplied by a factor of five to arrive at general population/uncontrolled data, warranted further investigation.

January 1999 Measurements

The measurements made in January 1999 were an effort to breakdown the overall exposure on the WTC2 observation deck walkway into individual station contributions. To achieve this, as was described earlier, all of the broadcast stations located on WTC1 and WTC2 went off the air and were brought back on the air individually, first employing the main station antenna and then the auxiliary station antenna (if the station has an auxiliary antenna at WTC1). In total, there were 18 different operational conditions measured at seven locations for a total of 126 measurements. Since the measurements were made with only one broadcast station on the air at a time, the measurements had to be made in rapid succession without the opportunity for analysis between measurements.

At first look, the data collected in January 1999 suggests exposures far in excess of the exposure data collected in December 1988. The sum of the

individual station exposures for the normal and auxiliary modes of operation are shown in the following table. Exposures are expressed as percentages of the FCC MPE for general population/uncontrolled exposure.

Operating Mode	Point 1	Point 1A	Point 1B	Point 2	Point 2A	Point 2B	Point 3
Normal Mode	149.94	152.27	127.89	202.62	236.83	247.32	240.62
Auxiliary Mode	161.24	187.93	182.64	189.93	264.78	288.27	286.02

Table 1. Summation of Measurement Data

The data shown in Table 1 of this report for the normal mode of operation were obtained with all broadcast stations at WTC1 operating using their main antennas. The data shown in the previous table for the auxiliary mode of operation were obtained with those stations with auxiliary antennas at WTC1 using their auxiliary antennas. Further, for the auxiliary mode, WCBS-TV not using its main antenna at WTC1 and was assumed to be using its auxiliary antenna at the Empire State Building, and the UHF stations at WTC1 were off the air.

It is evident that measured exposure levels for the normal operating mode are much higher than expected at all of the measurement locations. When compared to the measurement data from December 1998,

increases in exposure of over 100 percentage points are observed. As discussed earlier, this suggests a significant amount of background exposure from other nearby nonbroadcast stations.

In an effort to further examine the validity of the measurement data, exposure predictions were made at each measurement location for each of the operating modes. Where available, manufacturer's antenna data were employed to determine the ERP toward each target point. However, in many cases it was necessary to use approximations. The results of this comparison are in presented in graphical form in Figure 4 of this report. Each graph shows the calculated and measured data for each mode of operation. In virtually all cases, the measured exposure is higher than the calculated exposure indicating that possibly other radio-frequency sources were present and contributing to the exposure at the measurement points.

For each mode of operation surveyed, a trace was saved on a spectrum analyzer. The spectrum analyzer input was connected to a broadband biconic antenna placed in the center of the north observation deck walkway. The spectrum analyzer traces are included as Figure 6 of this report for each operational mode [illegible]

antenna gain and are included to illustrate the presence of a significant number of other radio-frequency sources while the survey measurements were being made.

RECOMMENDATIONS FOR FUTURE STUDIES

Since the initial objective of finding procedures by which the television stations operating from WTC1 could employ either the normal or auxiliary mode of operation without causing exposures in excess of the FCC MPE for general population/uncontrolled exposure on the observation deck walkway of WTC2 has not been achieved, further study is warranted. Descriptions of the next two steps recommended for further study follow.

The first step involves use of a new measurement probe recently made available to this firm by Narda. This probe, a Narda, model B8742D, is a shaped probe that conforms to the FCC MPE for general population/uncontrolled exposure.[2] The probe has a dynamic range of 30 dB,

[2] Up until the Narda, model B8742D, conformal electric field probe became available for use in measuring general population/uncontrolled exposures, a Narda, model 8722B, conformal electric field probe was used. Data obtained using the Narda, 8722B probe is expressed in terms of the MPE limit for occupational/controlled exposures and is divided by a factor of 5 to change the data reference to the MPE limit for general population/uncontrolled exposures.

which permits measurement of exposure levels from 0.6 percent to 600 percent of the FCC MPE for general population/uncontrolled exposure. Early experience with the probe indicates that the B8742D probe is much more stable than other conformal probes and has very little zero drift.

It is recommended that the December 1998 course of measurements, in which stations or pairs of stations switched to their auxiliary antennas while the remaining stations remained on the air, be repeated. The only change to the December protocol would be to measure the seven points (1, 1A, 1B, 2, 2A, 2B, 3) on the north walkway measured in January 1999 instead of all nine points around the walkway since previous measurements localized the exposure excursion to the north walkway. If exposures in excess of the MPE for general population/uncontrolled exposure are confirmed, then scenarios for reducing power can be explored and tested.

If the first step survey does not show exposure to be below the MPE limit for general population/uncontrolled exposures, the next recommended step involves employing a wide-band calibrated isotropic sensor with a constant antenna factor to characterize all of the RF energy incident upon the WTC2 outdoor observation deck walkway. The output of the sensor is

connected through a fiber optic cable to a computer-based receiver. The receiver converts the optical information back to radio-frequency energy that can be viewed on a spectrum analyzer. Employing the features of the spectrum analyzer to collect and store data points, an accurate depiction of the spectrum across a wide bandwidth can be achieved. The field strength data points can then be analyzed to determine the exposure contributions within specified bandwidths. This technique offers the ability to provide greater resolution of exposure data and provides the ability to breakdown exposure from multiple sources into individual station contributions. However, this technique will require time to develop and test. Since the equipment is not as suited to field use as other survey equipment, it will very likely take longer to collect and analyze the data.

CONCLUSIONS

The measurement surveys made at WTC2 have each produced vital information that has furthered the understanding of the complex radio-frequency exposure environment at WTC2. The December 1998 measurements clearly highlighted the auxiliary operating conditions under which the FCC MPEs for general population/uncontrolled exposure were

exceeded on the observation deck walkway of WTC2. The December 1998 data show that the FCC MPE for general population/uncontrolled exposure is only exceeded when WABC-TV, WWOR-TV, and WNET employ their auxiliary antennas. The January 1999 measurements, when analyzed as the worst-case, demonstrate that the auxiliary operations of WABC-TV, WWOR-TV, and WNET are not singularly responsible for the FCC MPE for general population/uncontrolled exposure being exceeded on the observation deck walkway at WTC2.

Further investigation of the WTC2 exposure levels is warranted. Since the initial objective of identifying procedures by which the broadcast stations at WTC1 can employ either their main or auxiliary antennas without exceeding the FCC MPE for general population/uncontrolled environments on the observation deck walkway at WTC2 has not been achieved and new instrumentation is available that is capable of measuring exposure directly in units of percent of the FCC MPE for general population/uncontrolled environments, additional studies will permit broadcasters at WTC1 to move closer and ultimately fulfil their objective of assuring compliance with the FCC Rules.

Robert W. Denny, Jr., P.E.

Alan R. Rosner, P.E.

March 17, 1999

Figure 1

ENGINEERING REPORT
ELECTROMAGNETIC FIELD STRENGTH SURVEY
AT THE SOUTH TOWER OF THE
WORLD TRADE CENTER

TV & FM STATIONS OPERATING AT THE WORLD TRADE CENTER

1. WCBS-TV, New York, New York
   Ch. 2, 21.4 kW (Max-BT), 482 m

2. WNBC(TV), New York, New York
   Ch. 4, 17.4 kW, 515 m

3. WNYW(TV), New York, New York
   Ch. 5, 17.4 kW, 515 m

4. WABC-TV, New York, New York
   Ch. 7, 64.6 kW (Max-BT), 491 m

5. WWOR-TV, Secaucus, New Jersey
   Ch. 9, 61.7 kW (Max-BT), 500 m

6. WPIX(TV), New York, New York
   Ch. 11, 58.9 kW (Max-BT), 506 m

7. WNET(TV), Newark, New Jersey
   Ch. 13, 60.3 kW (Max-BT), 500 m

8. WPXN-TV, New York, New York
   Ch. 31, 2820 kW (Max-DA, BT), 475 m
   Appl.: BPCT-961205KF
   Ch. 31, 5000 kW (Max-DA, BT), 475 m

9. WNJU(TV), Linden, New Jersey
   Ch. 47, 4570 kW (Max-DA, BT), 460 m

10. W60AI[1], New York, New York
    Ch. 60, 45.5 kW (Max-DA), 436 m

11. WKCR-FM, New York, New York
    Ch. 210B1, 0.63 kW (H&V), 433 m

12. WPAT-FM, Paterson, New Jersey
    Ch. 226B, 5.4 kW (H&V), 433 m

13. WNYC-FM, New York, New York
    Ch. 230B, 5.4 kW (H&V), 432 m

14. WKTU(FM), Lake Success, New York
    Ch. 278B, 5.4 kW (H&V), 432 m

[1] The W60AI antenna is located on the south tower of the World Trade Center (WTC2).

Figure 2

ENGINEERING REPORT
ELECTROMAGNETIC FIELD STRENGTH SURVEY
AT THE SOUTH TOWER OF THE
WORLD TRADE CENTER

Percent Occupational/Controlled Exposure Measured 12/17-18/98[1]

Operating Mode	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 2A
All Stations in Normal Mode	6.28	6.03	6.41	0.91	2.80	3.05	8.10	6.20	--
WNBC (CH 4) and WNYW (CH 5) on Auxiliary Antennas	8.10	7.52	7.30	2.29	4.74	3.86	9.21	14.65	--
WABC-TV (CH 7) on Auxiliary Antenna	13.35	11.38	11.58	2.04	6.63	8.75	8.05	12.98	22.37
WWOR-TV (CH 9) and WNET (CH 13) on Auxiliary Antennas	10.81	13.48	13.08	1.46	5.03	6.10	7.91	8.85	22.60
WPIX on Auxiliary Antenna	9.67	12.45	12.62	1.72	5.08	5.16	6.64	9.94	16.70

Calculated Percent General Population/Uncontrolled Exposure[2]

Operating Mode	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 2A
All Stations in Normal Mode	31.40	30.15	32.05	4.55	14.00	16.25	40.50	31.00	–
WNBC (CH 4) and WNYW (CH 5) on Auxiliary Antennas	40.50	37.60	36.50	11.45	23.70	19.30	46.05	73.25	–
WABC-TV (CH 7) on Auxiliary Antenna	66.75	56.90	57.90	10.20	26.15	43.75	40.25	64.75	111.85
WWOR-TV (CH 9) and WNET (CH 13) on Auxiliary Antennas	54.05	67.40	65.40	7.30	25.15	25.50	39.55	44.25	113.00
WPIX on Auxiliary Antenna	48.35	62.25	63.10	8.60	25.40	25.80	33.20	49.70	83.50

[1] See Figure 5 for identification of measurement locations.
[2] Calculated from measured occupational/controlled exposure data.

ENGINEERING REPORT
ELECTROMAGNETIC FIELD STRENGTH SURVEY
AT THE SOUTH TOWER OF THE
WORLD TRADE CENTER

COMPARISON OF MEASURED AND CALCULATED EXPOSURE DATA

Measurement Point 1

		Measured Data			Calculated Data						
Operating Mode	FCC MPE for GP/UC Exposure (mW/cm²)	Measured Electric Field Strength (V²/m²)	Equivalent Plane Wave Power Density (mW/cm²)	Percent FCC MPE for GP/UC Exposure	Slant Distance to Target (feet)	Depression Angle to Target (deg.)	Horizontal Plane Relative Field Factor	Vertical Plane Relative Field Factor	Total ERP Toward Target[1] (kW)	Equivalent Plane Wave Power Density (mW/cm²)	Percent FCC MPE for GP/UC Exposure
All Stations Off-the-Air	0.20	117.80	0.0312	15.60	--	--	--	--	--	--	--
WCBS-TV on Main Ant.	0.20	77.75	0.0206	10.30	353.1	32.8	0.920	0.160	0.464	0.0007	0.35
WNBC on Main Ant.	0.20	108.30	0.0287	14.35	443.7	48.0	0.920	0.350	1.804	0.0016	0.80
WNBC on Aux. Ant.	0.20	106.00	0.0281	14.05	305.2	15.4	0.920	0.730	7.848	0.0152	7.60
WNYW on Main Ant.	0.20	80.11	0.0212	10.60	443.7	48.0	0.900	0.450	2.854	0.0026	1.30
WNYW on Aux. Ant.	0.20	113.10	0.0300	15.00	303.4	14.3	0.660	0.690	9.609	0.0070	3.50
WABC-TV on Main Ant	0.20	98.90	0.0262	13.10	387.6	40.0	1.000*	0.500*	16.150	0.0193	9.65
WABC-TV on Aux. Ant.	0.20	240.30	0.0637	31.85	295.1	7.2	0.600	0.990	22.793	0.0471	23.55
WWOR-TV on Main Ant.	0.20	84.82	0.0225	11.25	405.2	42.8	1.000*	0.600*	16.425	0.0169	8.45
WWOR-TV on Aux. Ant.	0.20	120.10	0.0319	15.95	291.5	1.2	0.680	1.000	16.114	0.0341	17.05
WPIX on Main Ant.	0.20	110.70	0.0294	14.70	424.4	46.6	0.740	0.200*	1.361	0.0013	0.65
WPIX on Aux. Ant.	0.20	221.40	0.0587	29.35	293.5	5.1	0.540	1.000	17.175	0.0369	17.95
WNET on Main Ant.	0.20	186.10	0.0494	24.70	405.2	42.8	1.000*	0.500*	16.078	0.0165	8.25
WNET on Aux. Ant.	0.20	160.20	0.0425	21.25	292.7	3.9	0.600	1.000	11.976	0.0251	12.55
WPXN-TV on Main Ant.	0.38	122.50	0.0325	8.55	356.5	33.7	0.900	0.150*	51.395	0.0727	19.13
WNJU on Main Ant.	0.45	146.00	0.0387	8.60	328.8	25.8	1.000*	0.150*	102.625	0.1711	38.02
WG0AI on Main Ant.	0.50	89.53	0.0237	4.74							
WTC FM's on Master Ant.	0.20	219.10	0.0581	29.05	294.0	5.9	0.700	1.000*	19.727	0.0821	41.05

[1] Calculation of ERP based on manufacturer's horizontal and vertical plane pattern data unless otherwise noted.
* Assumed value.

Comparison of Measured And
Calculated Exposure Data

Figure 3
Sheet 2 of 7

Measurement Point 1A

Operating Mode	FCC MPE for GP/UC Exposure (mW/cm^2)	Measured Data: Measured Electric Field Strength (V^2/m^2)	Measured Data: Equivalent Plane Wave Power Density (mW/cm^2)	Measured Data: Percent FCC MPE for GP/UC Exposure	Calculated Data: Slant Distance to Target (feet)	Calculated Data: Depression Angle to Target (deg.)	Calculated Data: Horizontal Plane Relative Field Factor	Calculated Data: Vertical Plane Relative Field Factor	Calculated Data: Total ERP Toward Target[1] (kW)	Calculated Data: Equivalent Plane Wave Power Density (mW/cm^2)	Calculated Data: Percent FCC MPE for GP/UC Exposure
All Stations Off-the-Air	0.20	110.70	0.0294	14.70	--	--	--	--	--	--	--
WCBS-TV on Main Ant.	0.20	75.40	0.0200	10.00	364.3	31.7	0.920	0.100	0.181	0.0002	0.10
WNBC on Main Ant.	0.20	115.40	0.0306	15.30	462.7	46.7	0.900	0.350	1.727	0.0015	0.75
WNBC on Aux. Ant	0.20	113.10	0.0300	15.00	318.1	14.7	0.990	0.760	9.693	0.0170	8.50
WNYW on Main Ant.	0.20	84.82	0.0225	11.25	452.7	46.7	0.880	0.460	2.729	0.0024	1.20
WNYW on Aux. Ant.	0.20	96.60	0.0256	12.80	316.4	13.7	0.740	0.720	4.939	0.0089	4.45
WABC-TV on Main Ant.	0.20	108.30	0.0287	14.35	397.8	38.7	1.000*	0.500*	16.150	0.0184	9.20
WABC-TV on Aux. Ant.	0.20	230.90	0.0612	30.60	308.4	6.9	0.700	0.990	31.024	0.0587	29.35
WWOR-TV on Main Ant	0.20	70.68	0.0187	9.35	416.0	41.5	1.000*	0.500*	15.425	0.0161	8.05
WWOR-TV on Aux. Ant.	0.20	195.50	0.0519	25.95	305.0	1.1	0.660	1.000	20.866	0.0403	20.15
WPIX on Main Ant.	0.20	96.60	0.0256	12.80	433.8	44.3	0.740	0.200*	1.351	0.0013	0.65
WPIX on Aux. Ant.	0.20	296.80	0.0787	39.35	306.8	4.9	0.620	1.000	22.641	0.0432	21.60
WNET on Main Ant.	0.20	183.70	0.0487	24.35	415.0	41.5	1.000*	0.500*	15.075	0.0157	7.85
WNET on Aux. Ant.	0.20	190.80	0.0506	25.30	306.1	3.8	0.600	1.000	17.244	0.0331	16.55
WPXN-TV on Main Ant.	0.38	110.70	0.0294	7.74	367.6	32.5	0.900	0.160*	51.395	0.0684	18.00
WNJU on Main Ant.	0.45	139.00	0.0369	8.20	340.8	24.8	1.000*	0.150*	102.825	0.1692	35.38
WG0AI on Main Ant	0.50	91.80	0.0244	4.88							
WTC FM's on Master Ant.	0.20	256.80	0.0681	34.05	307.4	5.6	0.750	1.000*	22.646	0.0862	43.10

[1] Calculation of ERP based on manufacturer's horizontal and vertical plane pattern data unless otherwise noted.
* Assumed value

Comparison of Measured And
Calculated Exposure Data

Figure 3
Sheet 3 of 7

Measurement Point 1B

Operating Mode	FCC MPE for GP/UC Exposure (mW/cm²)	Measured Data: Measured Electric Field Strength (V²/m²)	Measured Data: Equivalent Plane Wave Power Density (mW/cm²)	Measured Data: Percent FCC MPE for GP/UC Exposure	Calculated Data: Slant Distance to Target (feet)	Calculated Data: Depression Angle to Target (deg.)	Calculated Data: Horizontal Plane Relative Field Factor	Calculated Data: Vertical Plane Relative Field Factor	Calculated Data: Total ERP Toward Target[1] (kW)	Calculated Data: Equivalent Plane Wave Power Density (mW/cm²)	Calculated Data: Percent FCC MPE for GP/UC Exposure
All Stations Off-the-Air	0.20	101.30	0.0269	13.45	--	--	--	--	--	--	--
WCBS-TV on Main Ant.	0.20	73.04	0.0194	9.70	377.0	30.6	0.920	0.100	0.181	0.0002	0.10
WNBC on Main Ant.	0.20	98.60	0.0262	13.10	463.0	45.3	0.880	0.350	1.661	0.0014	0.70
WNBC on Aux. Ant.	0.20	122.50	0.0325	16.25	332.6	14.0	1.000	0.760	10.050	0.0163	8.15
WNYW on Main Ant.	0.20	70.68	0.0187	9.35	463.0	45.3	0.860	0.450	2.606	0.0022	1.10
WNYW on Aux. Ant.	0.20	101.30	0.0269	13.45	330.9	13.0	0.820	0.740	6.407	0.0105	5.25
WABC-TV on Main Ant.	0.20	96.60	0.0256	12.80	409.6	37.3	1.000*	0.500*	16.160	0.0173	8.65
WABC-TV on Aux. Ant.	0.20	193.20	0.0512	25.60	323.3	6.6	0.860	0.990	46.827	0.0806	40.30
WWOR-TV on Main Ant.	0.20	58.90	0.0156	7.80	426.2	40.2	1.000*	0.500*	16.425	0.0163	7.65
WWOR-TV on Aux. Ant.	0.20	294.50	0.0781	39.05	320.1	1.1	0.820	1.000	32.208	0.0565	28.25
WPIX on Main Ant	0.20	58.90	0.0156	7.80	444.6	42.9	0.740	0.200*	1.361	0.0012	0.60
WPIX on Aux. Ant.	0.20	221.40	0.0587	29.35	321.8	4.6	0.800	1.000	37.696	0.0654	32.70
WNET on Main Ant.	0.20	139.00	0.0369	18.45	426.2	40.2	1.000*	0.500*	16.076	0.0149	7.45
WNET on Aux. Ant	0.20	195.50	0.0519	25.95	321.2	3.6	0.800	1.000	30.656	0.0534	26.70
WPXN-TV on Main Ant.	0.38	96.60	0.0256	6.74	380.2	31.2	0.840	0.160*	44.770	0.0567	14.66
WNJU on Main Ant.	0.45	155.50	0.0412	9.16	354.3	23.8	1.000*	0.160*	102.825	0.1473	32.73
WGOAI on Main Ant.	0.50	127.20	0.0337	6.74							
WTC FM's on Master Ant.	0.20	197.90	0.0525	26.25	322.3	5.4	0.800	1.000*	26.760	0.0892	44.60

[1] Calculation of ERP based on manufacturer's horizontal and vertical plane pattern data unless otherwise noted.
* Assumed value.

Comparison of Measured And
Calculated Exposure Data

Figure 3
Sheet 4 of 7

Measurement Point 2

Operating Mode	FCC MPE for GP/UC Exposure (mW/cm²)	Measured Data: Measured Electric Field Strength (V²/m²)	Measured Data: Equivalent Plane Wave Power Density (mW/cm²)	Measured Data: Percent FCC MPE for GP/UC Exposure	Calculated Data: Slant Distance to Target (feet)	Calculated Data: Depression Angle to Target (deg.)	Calculated Data: Horizontal Plane Relative Field Factor	Calculated Data: Vertical Plane Relative Field Factor	Calculated Data: Total ERP Toward Target[1] (kW)	Calculated Data: Equivalent Plane Wave Power Density (mW/cm²)	Calculated Data: Percent FCC MPE for GP/UC Exposure
All Stations Off-the-Air	0.20	164.90	0.0437	21.85	--	--	--	--	--	--	--
WCDS-TV on Main Ant	0.20	143.70	0.0381	19.05	391.1	20.2	0.920	0.110	0.219	0.0003	0.16
WNBC on Main Ant.	0.20	172.00	0.0456	22.80	474.6	43.8	0.880	0.350	1.651	0.0013	0.65
WNBC on Aux. Ant	0.20	146.00	0.0387	19.35	348.5	13.4	1.000	0.790	10.859	0.0101	5.06
WNYW on Main Ant.	0.20	148.40	0.0394	19.70	474.6	43.8	0.850	0.450	2.646	0.0020	1.00
WNYW on Aux. Ant.	0.20	157.80	0.0419	20.95	347.0	12.4	0.880	0.760	7.783	0.0116	5.80
WABC-TV on Main Ant	0.20	179.00	0.0475	23.75	422.5	36.0	1.000*	0.500*	16.150	0.0163	8.15
WABC-TV on Aux. Ant.	0.20	230.90	0.0612	30.60	339.7	6.3	0.960	0.990	68.351	0.0909	45.45
WWOR-TV on Main Ant.	0.20	186.10	0.0494	24.70	438.8	38.8	1.000*	0.500*	15.425	0.0144	7.20
WWOR-TV on Aux. Ant	0.20	226.20	0.0600	30.00	336.6	1.0	0.940	1.000	42.324	0.0672	33.60
WPIX on Main Ant.	0.20	73.04	0.0194	9.70	456.6	41.4	0.750	0.200*	1.388	0.0012	0.60
WPIX on Aux. Ant.	0.20	164.90	0.0437	21.85	338.3	4.4	0.940	1.000	52.044	0.0818	40.90
WNET on Main Ant.	0.20	143.70	0.0381	19.05	438.8	38.8	1.000*	0.500*	15.075	0.0141	7.05
WNET on Aux. Ant.	0.20	216.70	0.0575	28.75	337.7	3.4	0.920	1.000	40.643	0.0639	31.95
WPXN-TV on Main Ant	0.38	169.60	0.0450	11.84	394.2	30.0	0.840	0.160*	44.770	0.0518	13.63
WNJU on Main Ant.	0.45	230.90	0.0612	13.60	369.3	22.7	1.000*	0.160*	102.825	0.1355	30.11
WG0AI on Main Ant	0.50	129.60	0.0344	6.88							
WTC FM's on Master Ant	0.20	237.90	0.0631	31.65	338.8	5.1	0.830	1.000*	27.735	0.0869	43.45

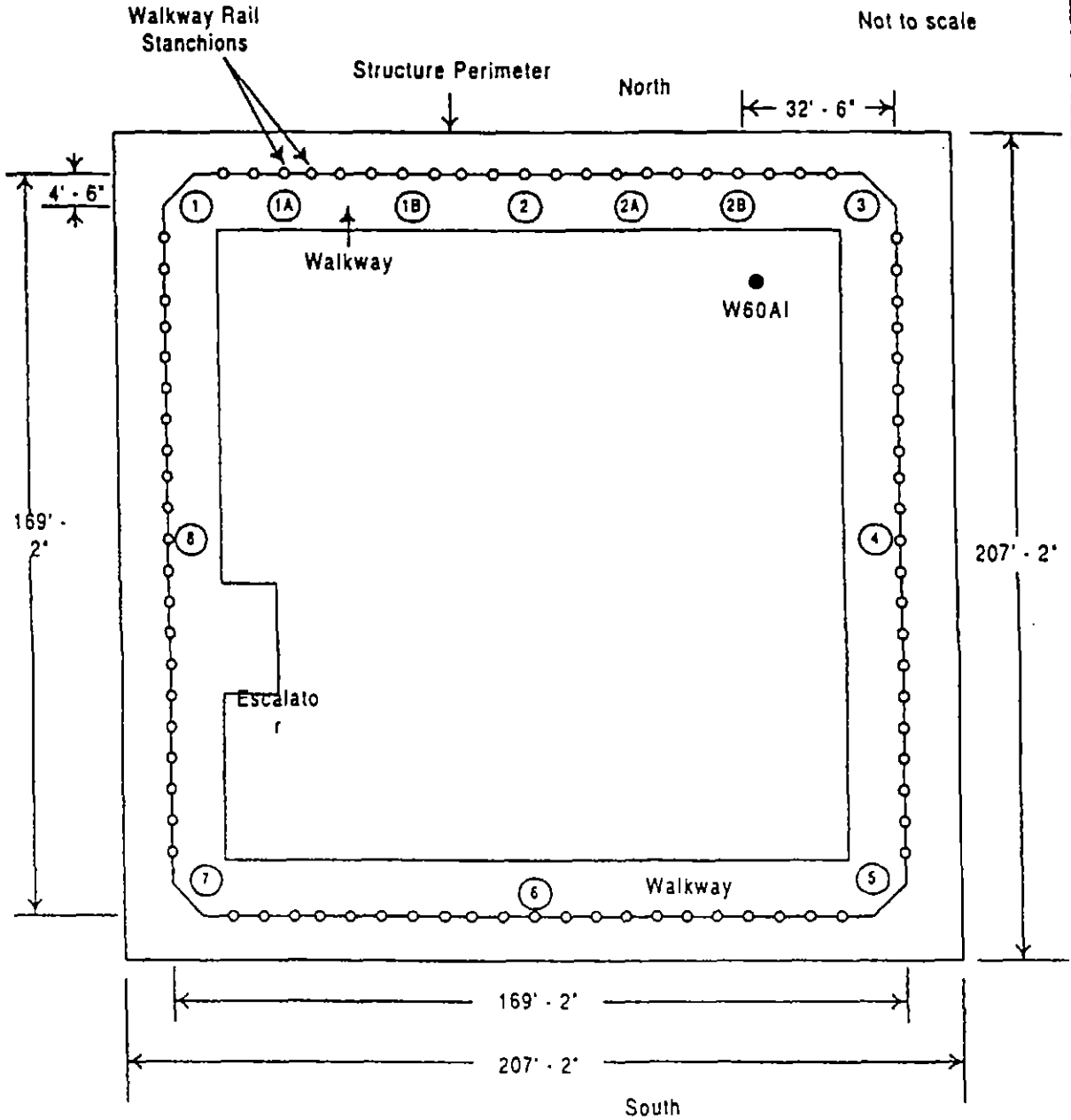
[1] Calculation of ERP based on manufacturer's horizontal and vertical plane pattern data unless otherwise noted.
* Assumed value.

Figure 5

MARCH 1999

Notes: 1. Measurement locations are indicated by circled numbers and letters, e.g. (1A)

2. Observation deck walkway is approximately 9 feet above building roof level.



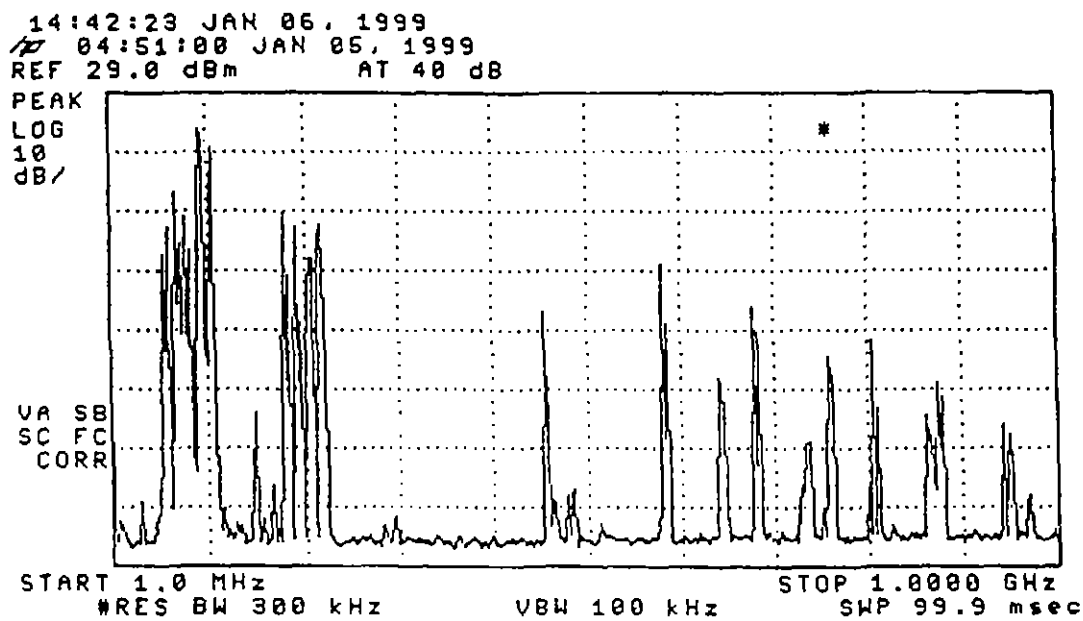
MEASUREMENT LOCATIONS
WORLD TRADE CENTER
SOUTH TOWER ROOFTOP OBSERVATION DECK WALKWAY

Denny & Associates, P.C. Consulting Engineers

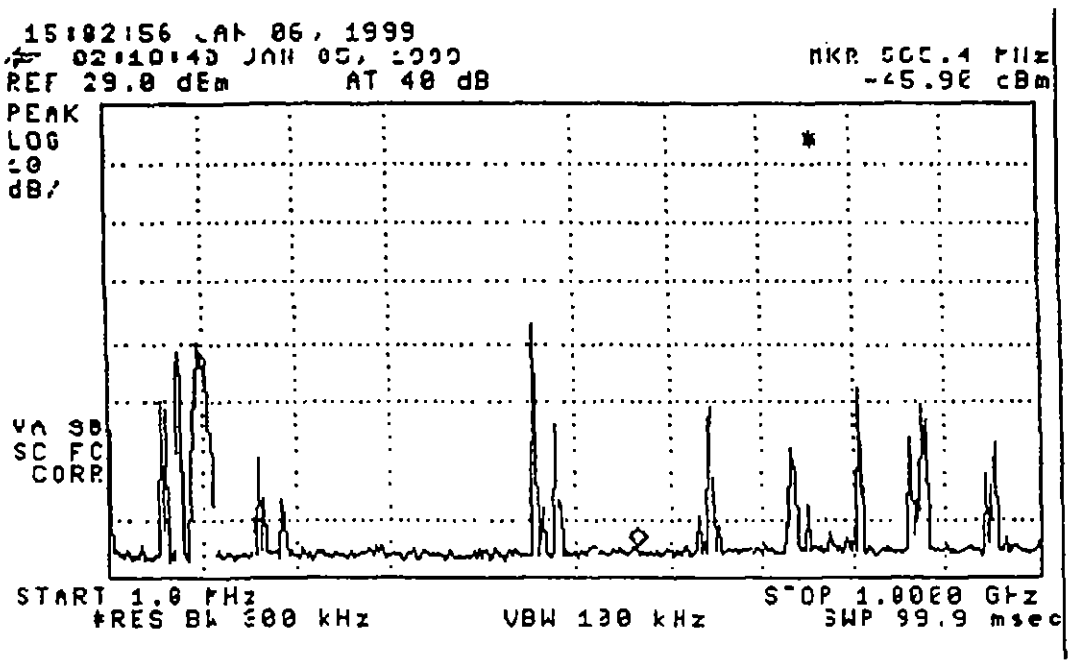
Figure 6
Sheet 1 of 10

ENGINEERING REPORT
ELECTROMAGNETIC FIELD STRENGTH SURVEY
AT THE SOUTH TOWER OF THE
WORLD TRADE CENTER

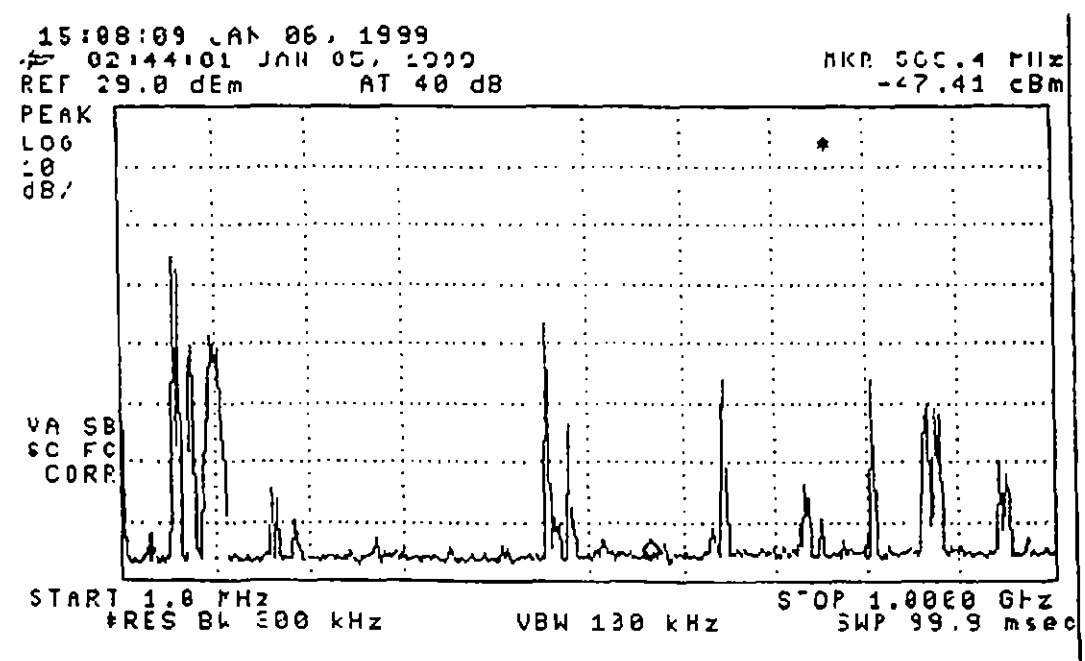
SPECTRUM ANALYZER PLOTS FOR
SINGLE-STATION MEASUREMENT PERIODS



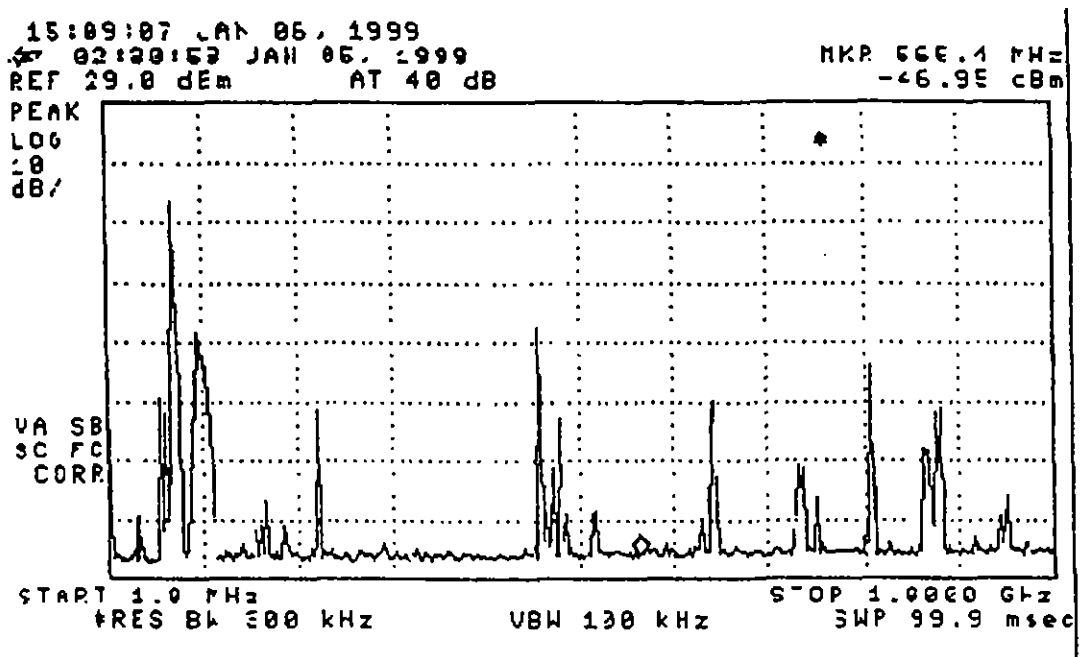
All WTC Stations in Normal Operating Mode



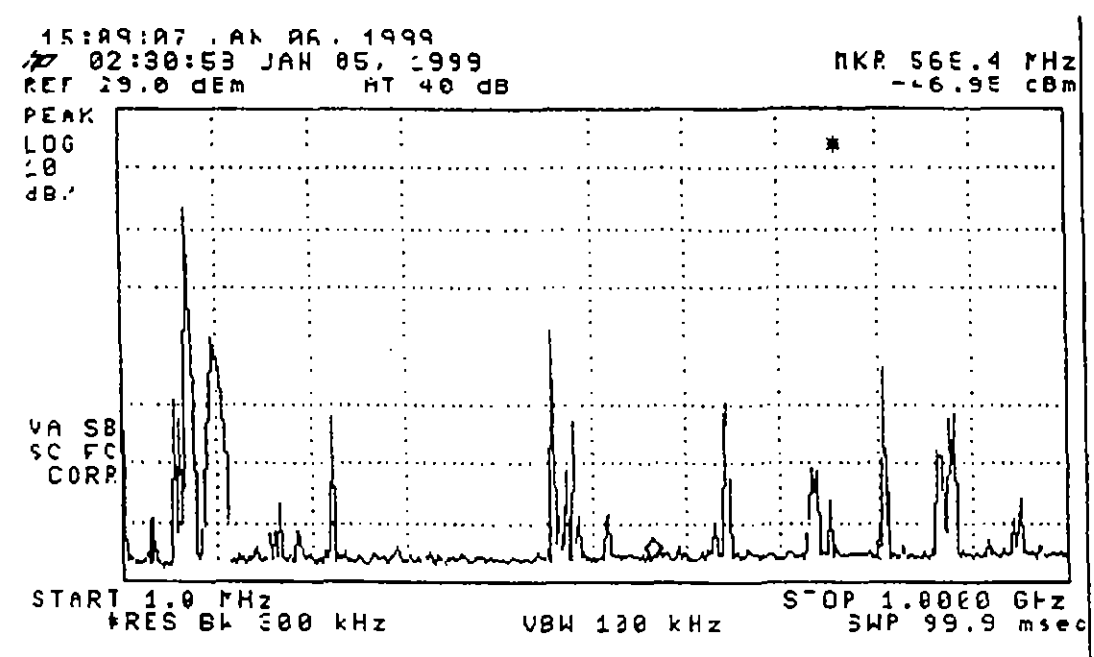
All WTC Stations Off-the-Air



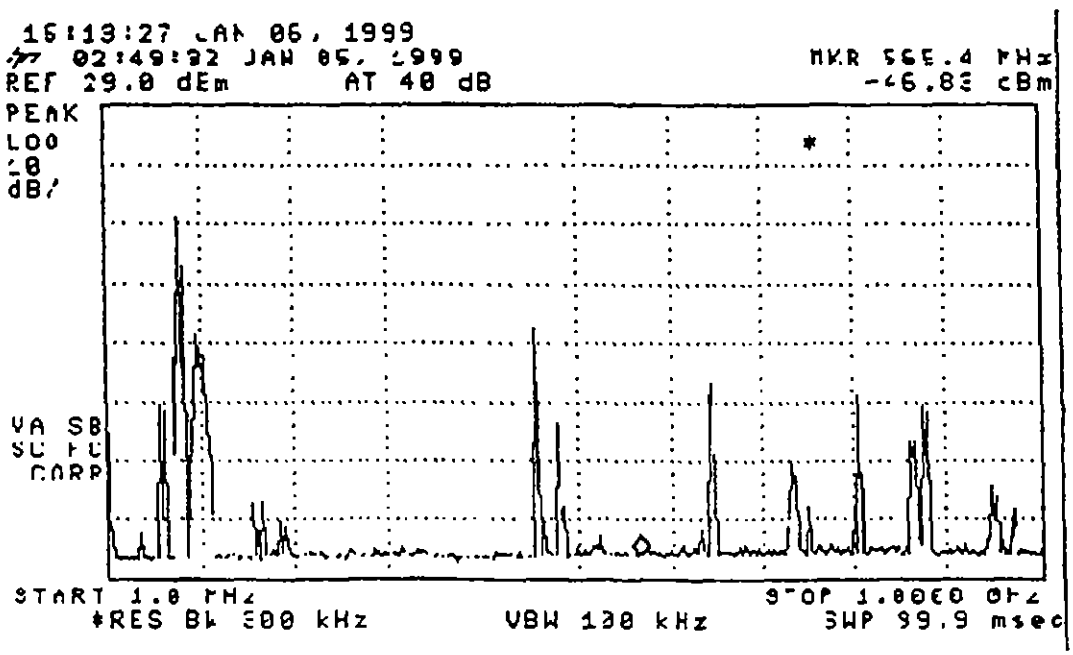
WCBS-TV (54-60 MHz) Operating with Main Antenna



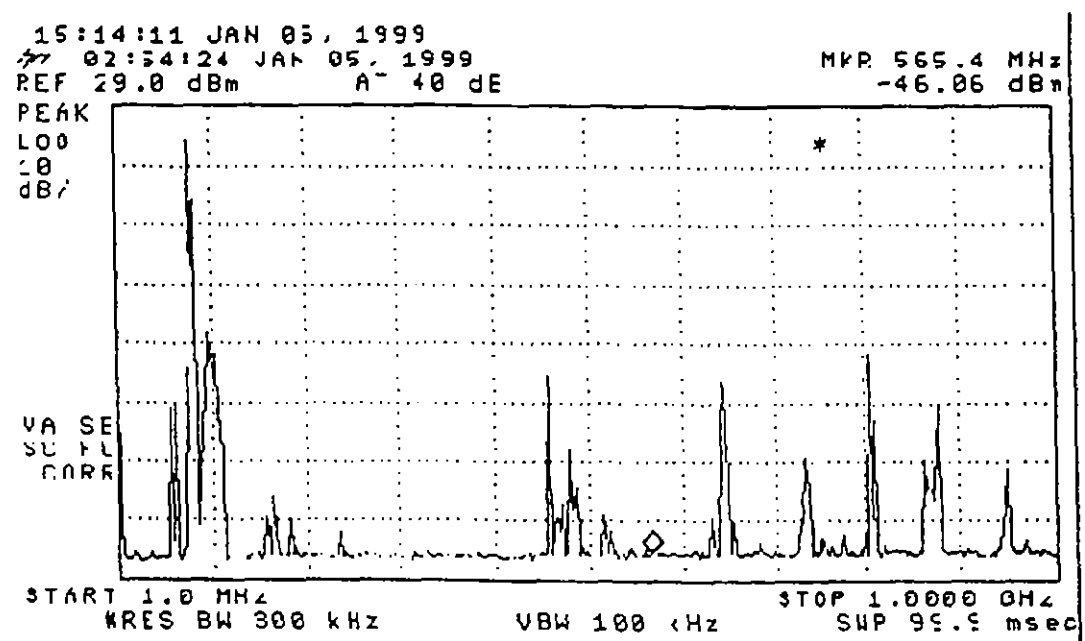
WNBC (66-72 MHz) Operating with Main Antenna



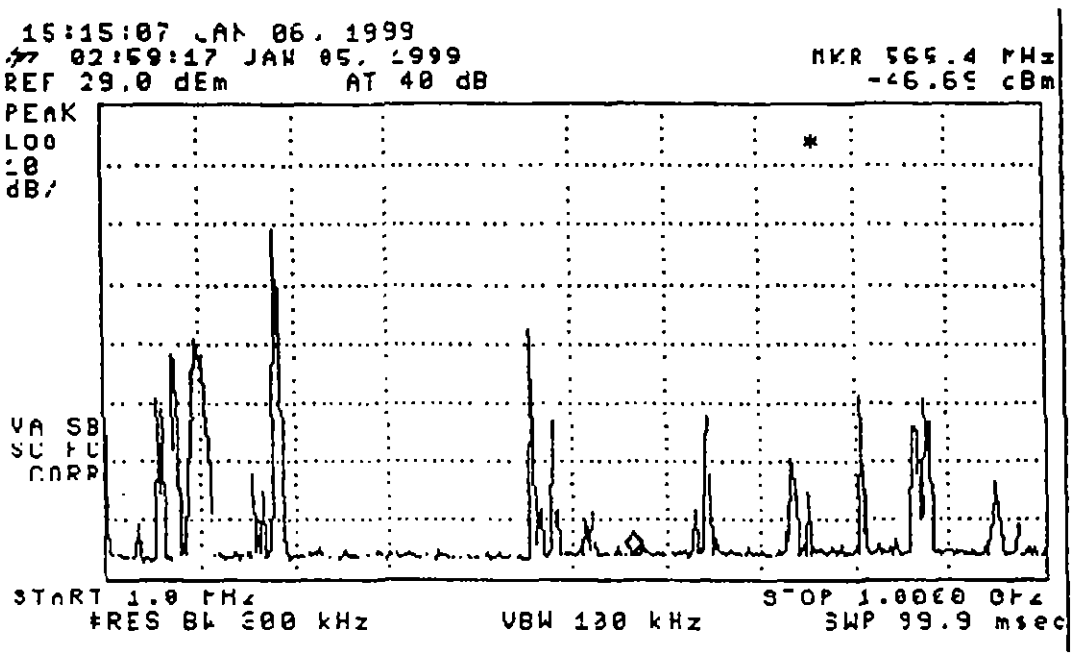
WNBC (66-72 MHz) Operating with Auxiliary Antenna



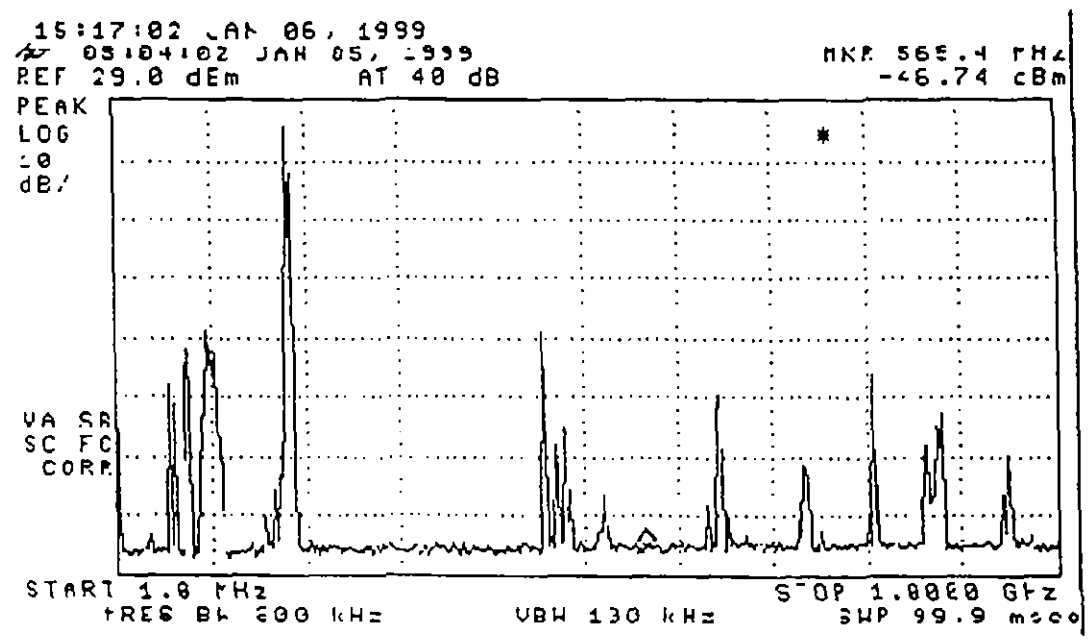
WNYW (76-82 MHz) Operating with Main Antenna



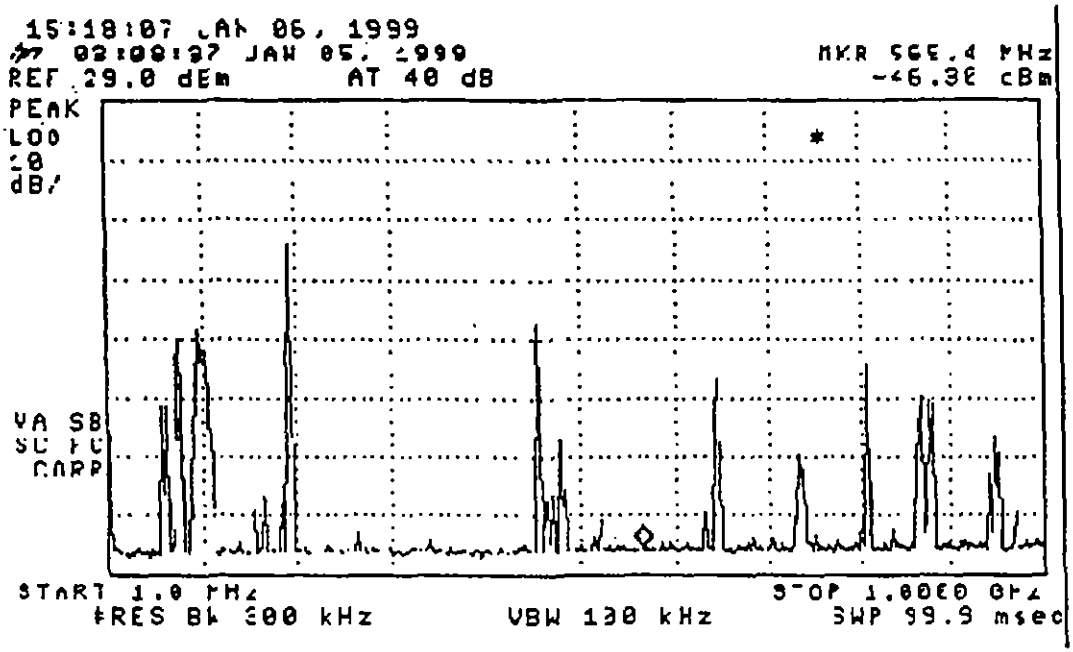
WNYW (76-82 MHz) Operating with Auxiliary Antenna



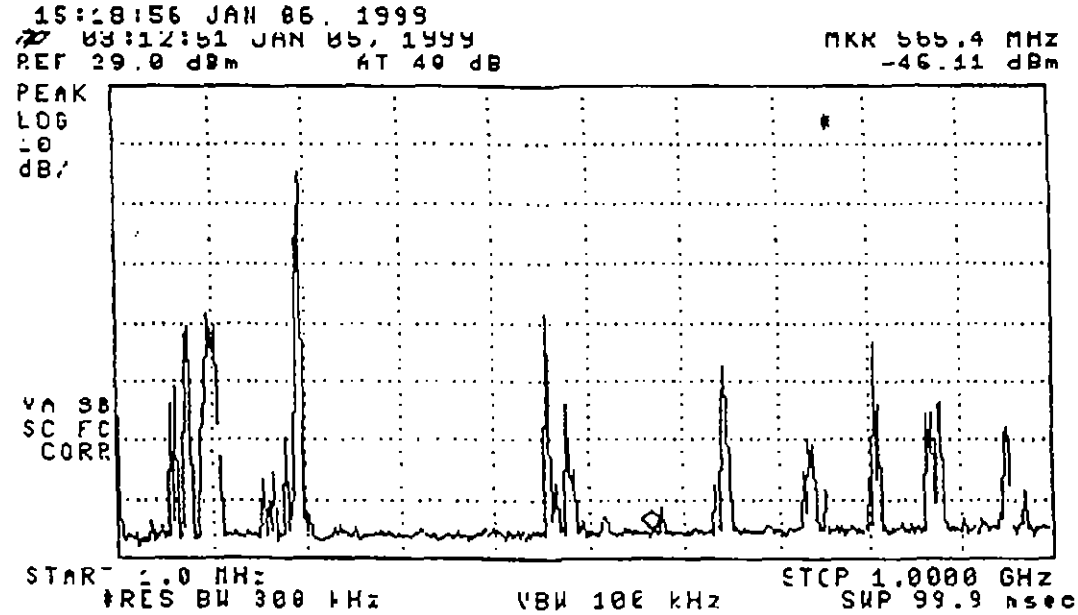
WABC-TV (174-180 MHz) Operating with Main Antenna



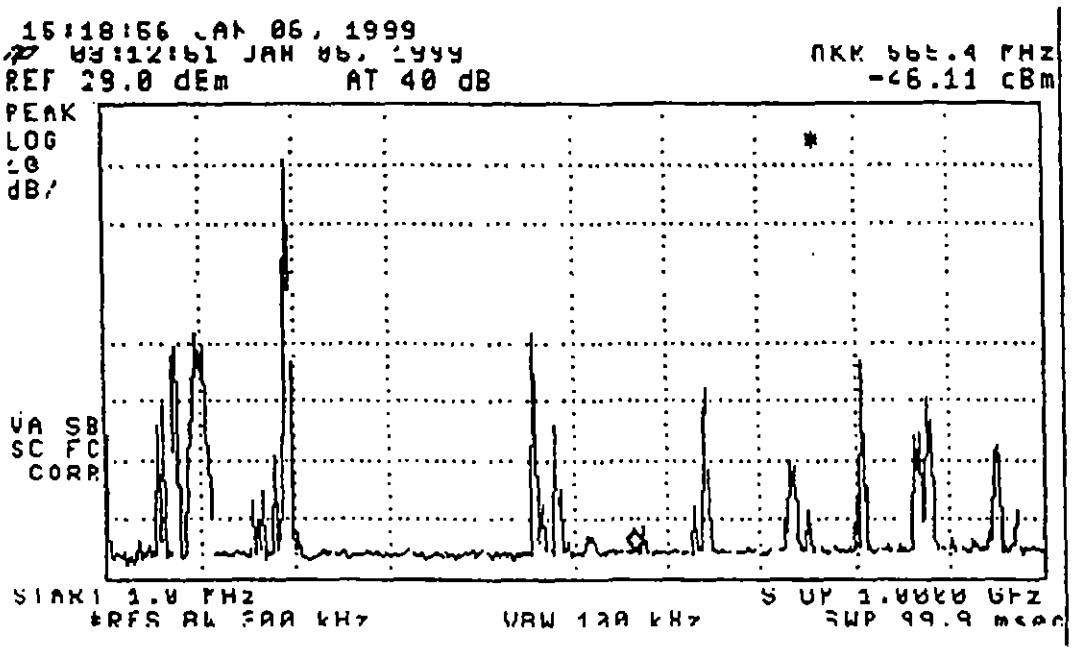
WABC-TV (174-180 MHz) Operating with Auxiliary Antenna



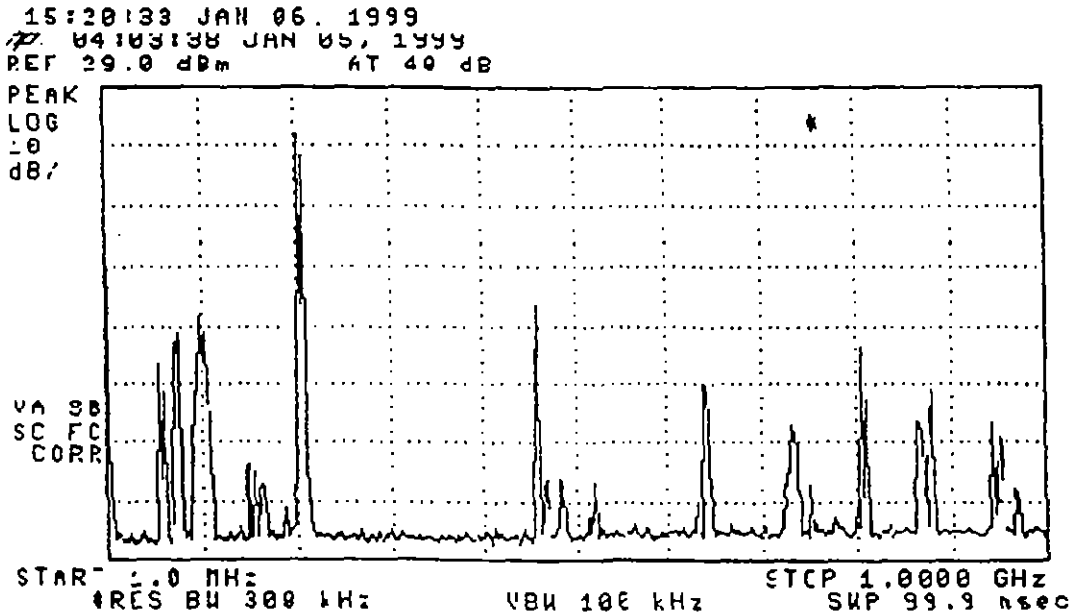
WWOR-TV (186-192 MHz) Operating with Main Antenna



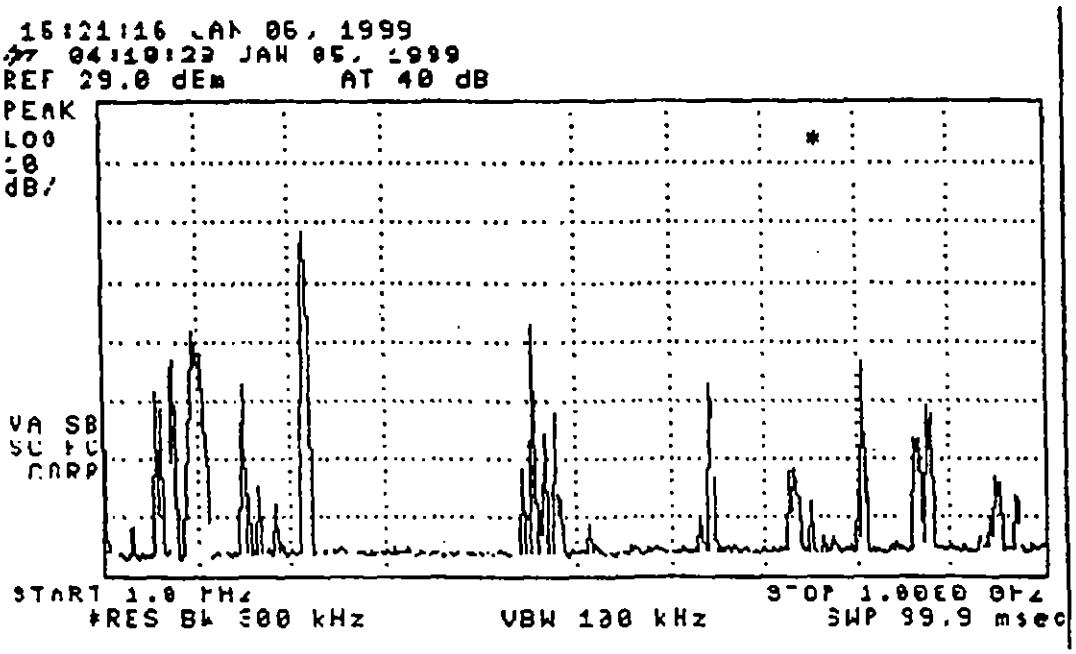
WWOR-TV (186-192 MHz) Operating with Auxiliary Antenna



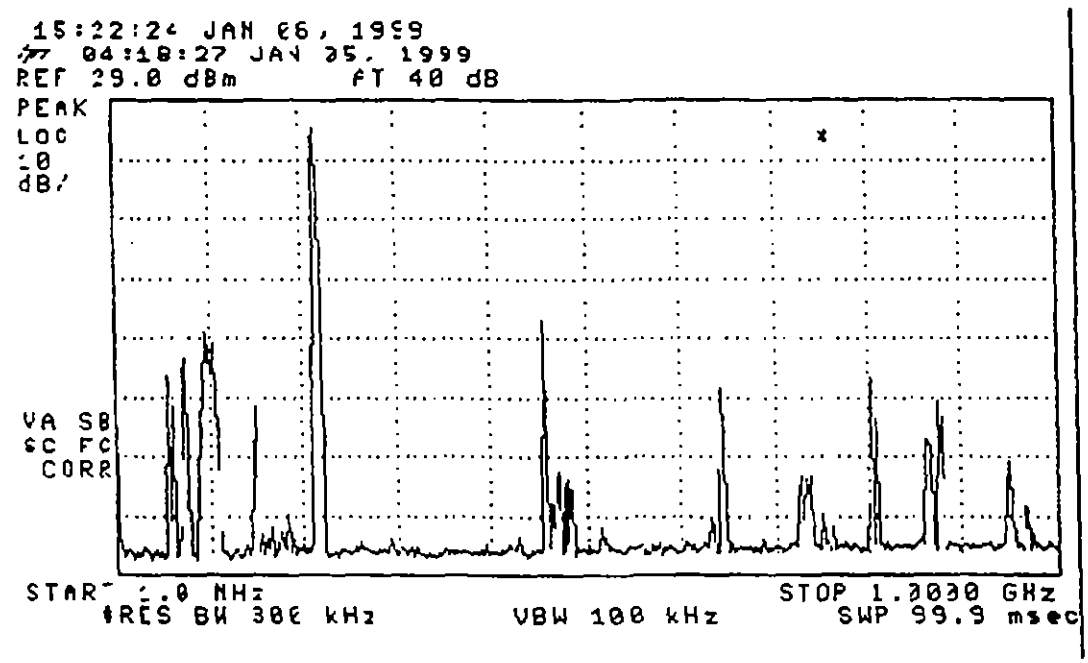
WPIX (198-204 MHz) Operating with Main Antenna



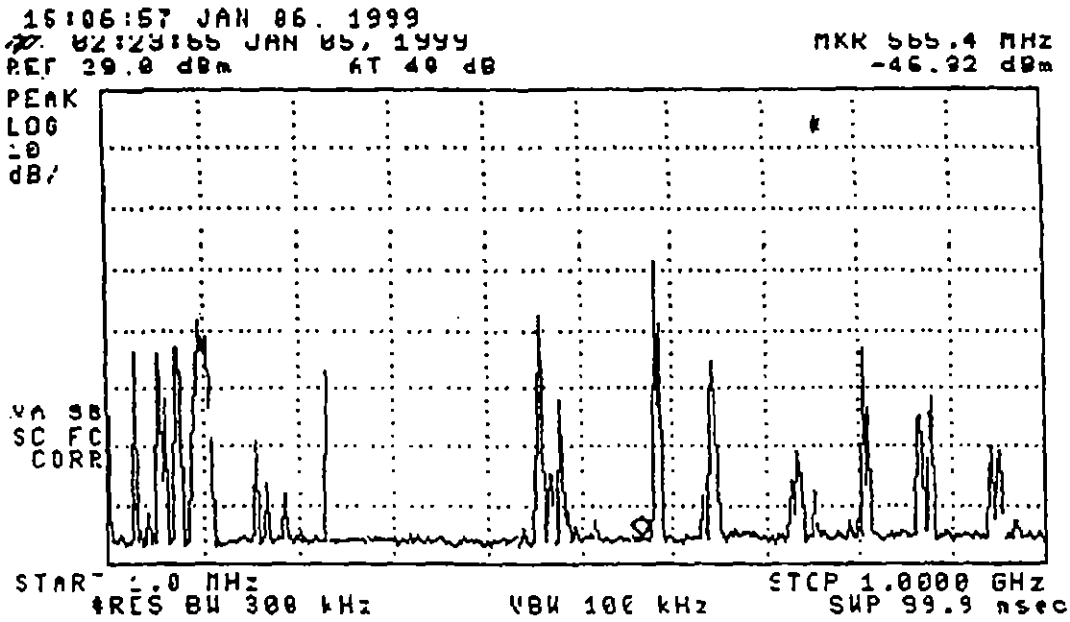
WPIX (198-204 MHz) Operating with Auxiliary Antenna



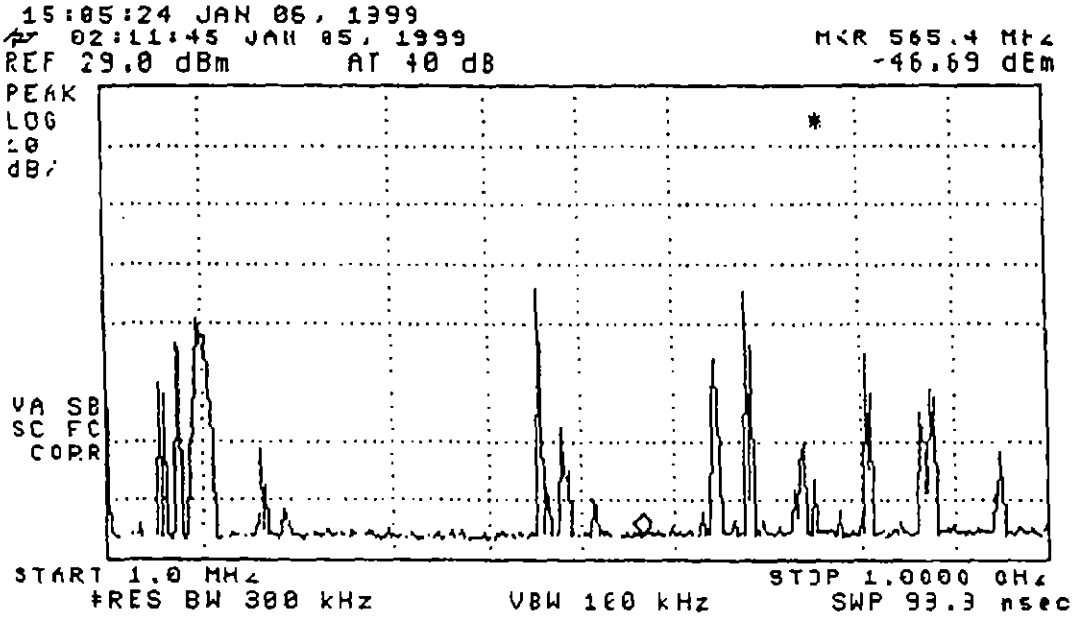
WNET (210-216 MHz) Operating with Main Antenna



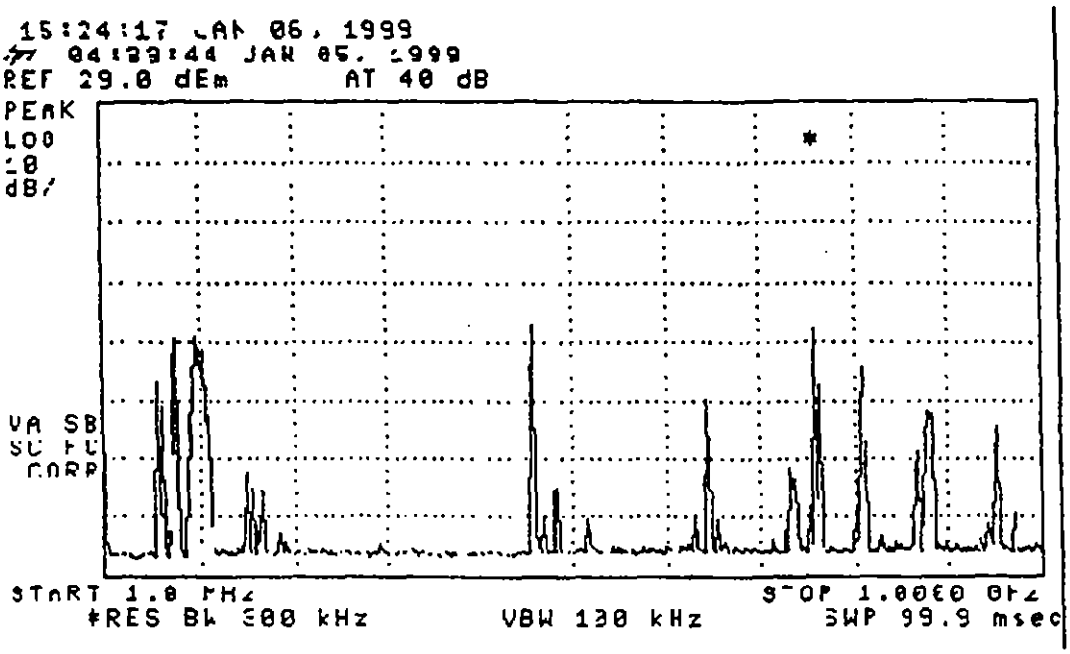
WNET (210-216 MHz) Operating with Auxiliary Antenna



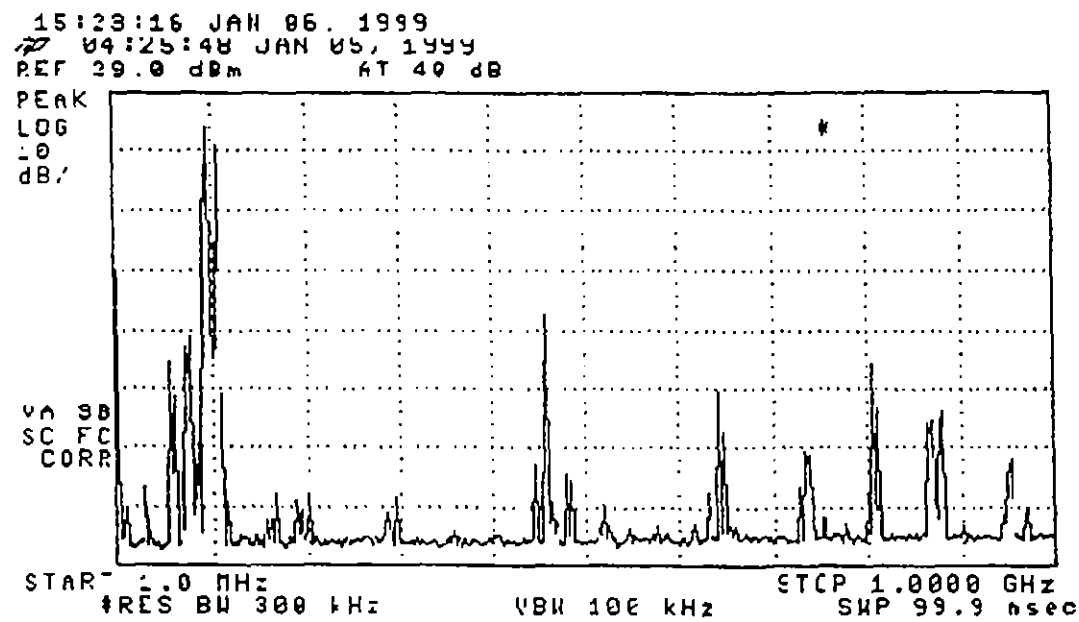
WPXN-TV (572-578 MHz) Operating with Main Antenna



WNJU (668-674 MHz) Operating with Main Antenna



W60AI (746-752 MHz) Operating with Main Antenna



WTC FM Stations Operating into Master Antenna

Figure 3
Sheet 5 of 7

Comparison of Measured And
Calculated Exposure Data

Measurement Point 2A

Operating Mode	FCC MPE for GP/UC Exposure (mW/cm²)	Measured Data: Measured Electric Field Strength (V²/m²)	Measured Data: Equivalent Plane Wave Power Density (mW/cm²)	Measured Data: Percent FCC MPE for GP/UC Exposure	Calculated Data: Slant Distance to Target (feet)	Calculated Data: Depression Angle to Target (deg.)	Calculated Data: Horizontal Plane Relative Field Factor	Calculated Data: Vertical Plane Relative Field Factor	Calculated Data: Total ERP Toward Target[1] (kW)	Calculated Data: Equivalent Plane Wave Power Density (mW/cm²)	Calculated Data: Percent FCC MPE for GP/UC Exposure
All Stations Off-the-Air	0.20	228.5	0.0606	30.30	--	--	--	--	--	--	--
WCBS-TV on Main Ant.	0.20	169.6	0.0450	22.50	406.6	28.0	0.920	0.160	0.408	0.0004	0.20
WNBC on Main Ant	0.20	188.5	0.0500	25.00	487.4	42.4	0.880	0.350	1.651	0.0012	0.60
WNBC on Aux. Ant.	0.20	179	0.0475	23.75	365.7	12.7	0.960	0.800	10.263	0.0138	6.90
WNYW on Main Ant.	0.20	174.3	0.0462	23.10	487.4	42.4	0.840	0.450	2.486	0.0019	0.95
WNYW on Aux. Ant.	0.20	214.4	0.0569	28.45	364.3	11.8	0.950	0.780	9.564	0.0129	6.45
WABC-TV on Main Ant.	0.20	186.1	0.0494	24.70	436.8	34.6	1.000*	0.500*	16.160	0.0152	7.60
WABC-TV on Aux. Ant.	0.20	306.3	0.0812	40.60	357.3	6.0	1.000	0.990	63.314	0.0892	44.60
WWOR-TV on Main Ant.	0.20	179	0.0475	23.75	452.6	37.3	1.000*	0.500*	16.425	0.0135	6.75
WWOR-TV on Aux. Ant.	0.20	381.7	0.1012	50.60	354.4	1.0	1.000	1.000	47.900	0.0686	34.30
WPIX on Main Ant.	0.20	113.1	0.0300	15.00	469.9	40.0	0.780	0.200*	1.502	0.0012	0.60
WPIX on Aux. Ant.	0.20	263.9	0.0700	35.00	356.0	4.2	1.000	1.000	58.900	0.0836	41.80
WNET on Main Ant.	0.20	155.5	0.0412	20.60	452.6	37.3	1.000*	0.500*	16.076	0.0132	6.60
WNET on Aux. Ant.	0.20	245	0.0650	32.50	355.4	3.2	1.000	1.000	47.900	0.0682	34.10
WPXN-TV on Main Ant	0.38	214.4	0.0569	14.97	409.5	28.7	0.800	0.150	40.608	0.0435	11.45
WNJU on Main Ant.	0.45	226.2	0.0600	13.33	385.6	21.7	1.000*	0.150*	102.825	0.1243	27.62
WGOAJ on Main Ant	0.50	167.2	0.0444	8.88							
WTC FM's on Master Ant.	0.20	339.3	0.0900	45.00	356.6	4.8	0.830	1.000*	27.735	0.0786	39.25

[1] Calculation of ERP based on manufacturer's horizontal and vertical plane pattern data unless otherwise noted.
* Assumed value.

Comparison of Measured And
Calculated Exposure Data

Measurement Point 2B

Operating Mode	FCC MPE for GP/UC Exposure (mW/cm²)	Measured Data: Measured Electric Field Strength (V²/m²)	Measured Data: Equivalent Plane Wave Power Density (mW/cm²)	Measured Data: Percent FCC MPE for GP/UC Exposure	Calculated Data: Slant Distance to Target (feet)	Calculated Data: Depression Angle to Target (deg.)	Calculated Data: Horizontal Plane Relative Field Factor	Calculated Data: Vertical Plane Relative Field Factor	Calculated Data: Total ERP Toward Target[1] (kW)	Calculated Data: Equivalent Plane Wave Power Density (mW/cm²)	Calculated Data: Percent FCC MPE for GP/UC Exposure
All Stations Off-the-Air	0.20	197.9	0.0525	26.25	--	--	--	--	--	--	--
WCBS-TV on Main Ant.	0.20	155.5	0.0412	20.60	423.0	26.8	0.920	0.170	0.623	0.0005	0.25
WNBC on Main Ant.	0.20	186.1	0.0494	24.70	501.2	40.9	0.880	0.350	1.651	0.0012	0.60
WNBC on Aux. Ant.	0.20	160.2	0.0425	21.25	384.0	12.1	0.920	0.820	9.903	0.0121	6.05
WNYW on Main Ant.	0.20	160.2	0.0425	21.25	501.2	40.9	0.840	0.450	2.486	0.0018	0.90
WNYW on Aux. Ant.	0.20	197.9	0.0525	26.25	382.6	11.2	0.980	0.800	10.695	0.0131	6.55
WABC-TV on Main Ant.	0.20	188.5	0.0500	25.00	452.2	33.2	1.000*	0.500*	16.150	0.0142	7.10
WABC-TV on Aux. Ant.	0.20	388.7	0.1031	51.55	376.0	6.7	1.000	1.000	64.600	0.0822	41.10
WWOR-TV on Main Ant.	0.20	174.3	0.0462	23.10	467.4	36.9	1.000*	0.500*	16.425	0.0127	6.35
WWOR-TV on Aux. Ant.	0.20	393.4	0.1044	52.20	373.2	0.9	1.000	1.000	47.900	0.0618	30.90
WPIX on Main Ant.	0.20	131.9	0.0350	17.50	484.2	38.6	0.780	0.200*	1.502	0.0012	0.60
WPIX on Aux. Ant.	0.20	280.3	0.0744	37.20	374.7	4.0	1.000	1.000	58.900	0.0754	37.70
WNET on Main Ant.	0.20	195.5	0.0519	25.95	467.4	36.9	1.000*	0.500*	16.075	0.0124	6.20
WNET on Aux. Ant.	0.20	278	0.0737	36.85	374.2	3.1	1.000	1.000	47.900	0.0615	30.75
WPXN-TV on Main Ant.	0.38	193.2	0.0512	13.47	425.9	27.5	0.900	0.160*	51.395	0.0509	13.39
WNJU on Main Ant	0.45	216.7	0.0575	12.78	403.0	20.7	1.000*	0.150*	102.825	0.1139	25.31
WGOAJ on Main Ant	0.50	303.9	0.0806	16.12							
WTC FM's on Master Ant.	0.20	353.4	0.0937	46.85	376.1	4.6	0.830	1.000*	27.735	0.0709	35.45

[1] Calculation of ERP based on manufacturer's horizontal and vertical plane pattern data unless otherwise noted.
* Assumed value.

Comparison of Measured And
Calculated Exposure Data

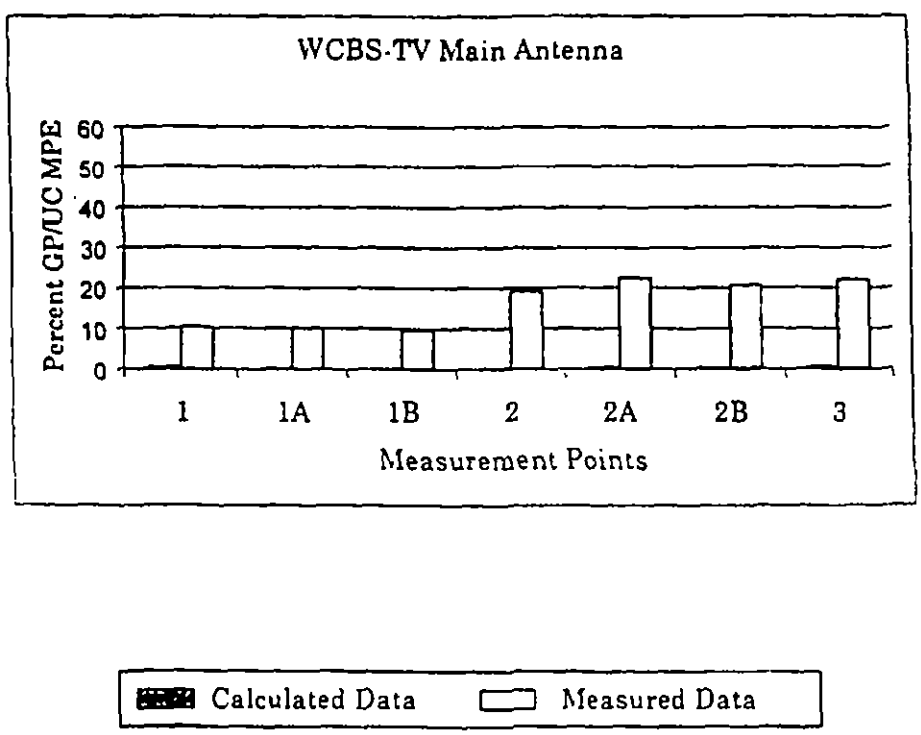
Measurement Point 3

Operating Mode	FCC MPE for GP/UC Exposure (mW/cm²)	Measured Data: Measured Electric Field Strength (V²/m²)	Measured Data: Equivalent Plane Wave Power Density (mW/cm²)	Measured Data: Percent FCC MPE for GP/UC Exposure	Calculated Data: Slant Distance to Target (feet)	Calculated Data: Depression Angle to Target (deg.)	Calculated Data: Horizontal Plane Relative Field Factor	Calculated Data: Vertical Plane Relative Field Factor	Calculated Data: Total ERP Toward Target[1] (kW)	Calculated Data: Equivalent Plane Wave Power Density (mW/cm²)	Calculated Data: Percent FCC MPE for GP/UC Exposure
All Stations Off-the-Air	0.20	214.40	0.0569	28.45	--	--	--	--	--	--	--
WCBS-TV on Main Ant.	0.20	164.90	0.0437	21.85	440.6	25.6	0.910	0.200	0.709	0.0007	0.35
WNBC on Main Ant	0.20	183.70	0.0487	24.35	516.1	39.4	0.880	0.360	1.651	0.0011	0.55
WNBC on Aux. Ant.	0.20	181.40	0.0481	24.05	403.2	11.5	0.880	0.840	9.508	0.0105	5.25
WNYW on Main Ant.	0.20	174.30	0.0462	23.10	516.1	39.4	0.840	0.450	2.486	0.0017	0.85
WNYW on Aux. Ant.	0.20	202.60	0.0537	26.85	401.9	10.7	1.000	0.820	11.700	0.0130	6.50
WABC-TV on Main Ant.	0.20	197.90	0.0525	26.25	468.7	31.9	1.000*	0.500*	16.150	0.0132	6.60
WABC-TV on Aux. Ant	0.20	360.50	0.0956	47.80	395.6	5.4	0.980	1.000	62.042	0.0713	35.65
WWOR-TV on Main Ant	0.20	202.60	0.0537	26.85	483.4	34.5	1.000*	0.500*	15.425	0.0119	5.95
WWOR-TV on Aux. Ant.	0.20	419.40	0.1112	55.60	393.0	0.9	0.960	1.000	44.145	0.0514	25.70
WPIX on Main Ant.	0.20	141.30	0.0375	18.75	499.6	37.1	0.800	0.200*	1.580	0.0011	0.55
WPIX on Aux. Ant.	0.20	393.40	0.1044	52.20	394.4	3.8	0.980	1.000	56.568	0.0654	32.70
WNET on Main Ant.	0.20	183.70	0.0487	24.35	483.4	34.6	1.000*	0.500*	15.075	0.0116	5.80
WNET on Aux. Ant.	0.20	252.10	0.0669	33.45	393.9	2.9	0.950	1.000	43.230	0.0501	25.05
WPXN-TV on Main Ant.	0.38	221.40	0.0587	15.45	443.3	26.3	0.800	0.150*	40.608	0.0371	9.76
WNJU on Main Ant.	0.45	230.90	0.0612	13.60	421.3	19.7	1.000*	0.150*	102.625	0.1041	23.13
WGOA on Main Ant.	0.50	190.80	0.0506	10.12							
WTC FM's on Master Ant.	0.20	270.90	0.0719	35.95	394.8	4.4	0.620	1.000*	27.071	0.0625	31.25

[1] Calculation of ERP based on manufacturer's horizontal and vertical plane pattern data unless otherwise noted.
* Assumed value.

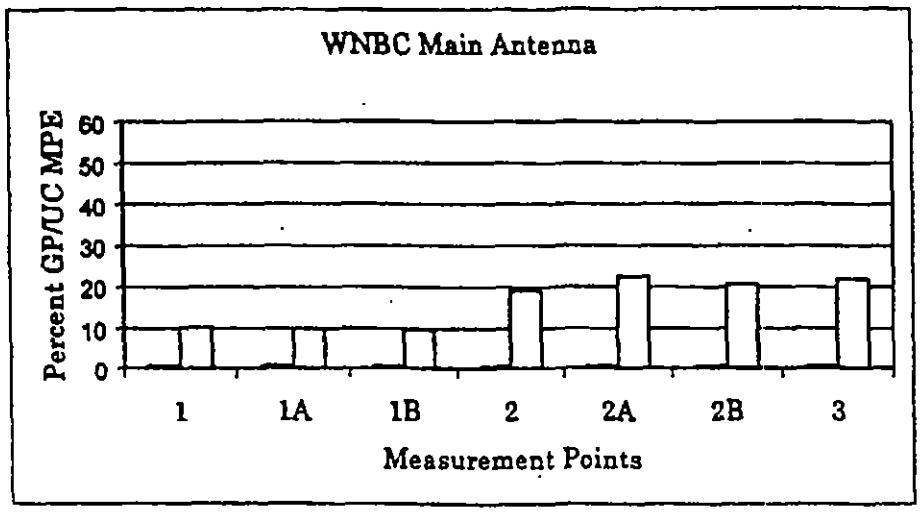
ENGINEERING REPORT
ELECTROMAGNETIC FIELD STRENGTH SURVEY
AT THE SOUTH TOWER OF THE
WORLD TRADE CENTER

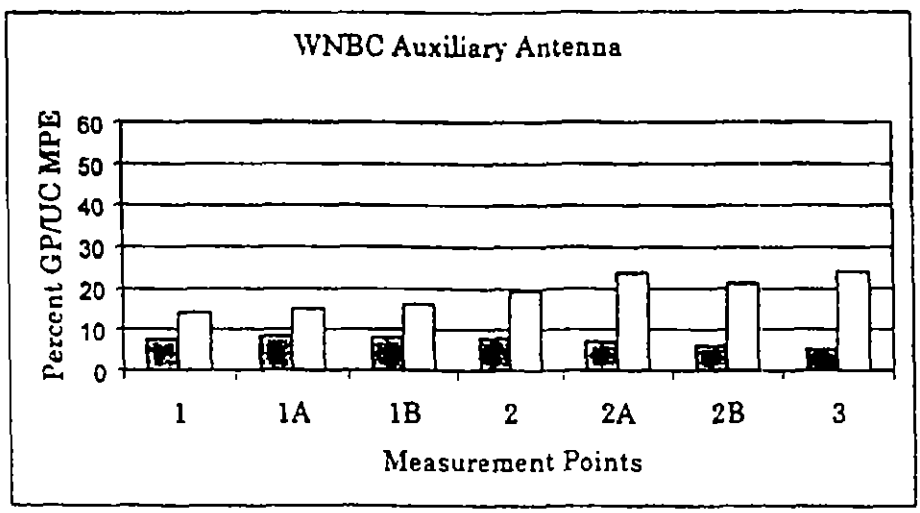
GRAPHICAL COMPARISON OF MEASURED AND CALCULATED EXPOSURE LEVELS

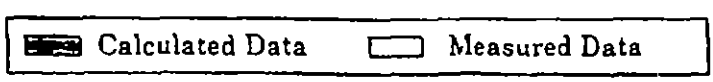


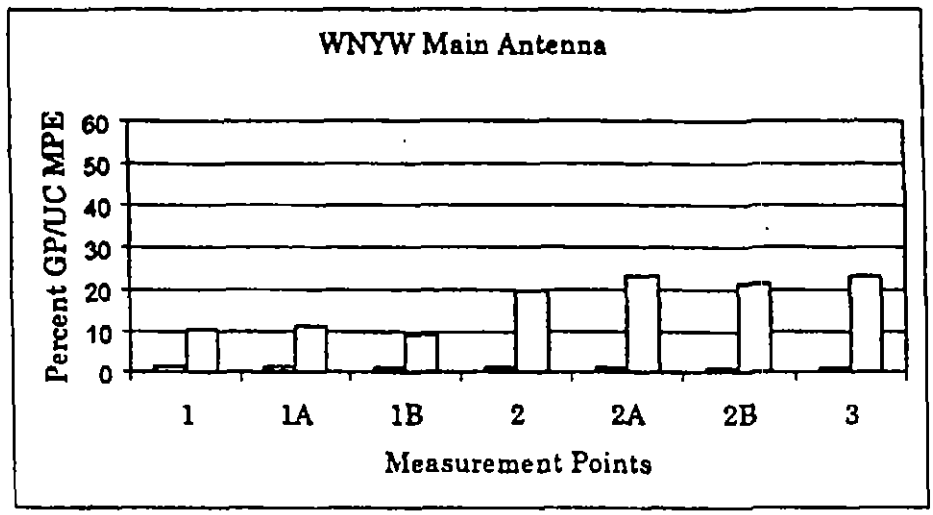
Graphical Comparison Of Measured And Calculated Exposure Levels

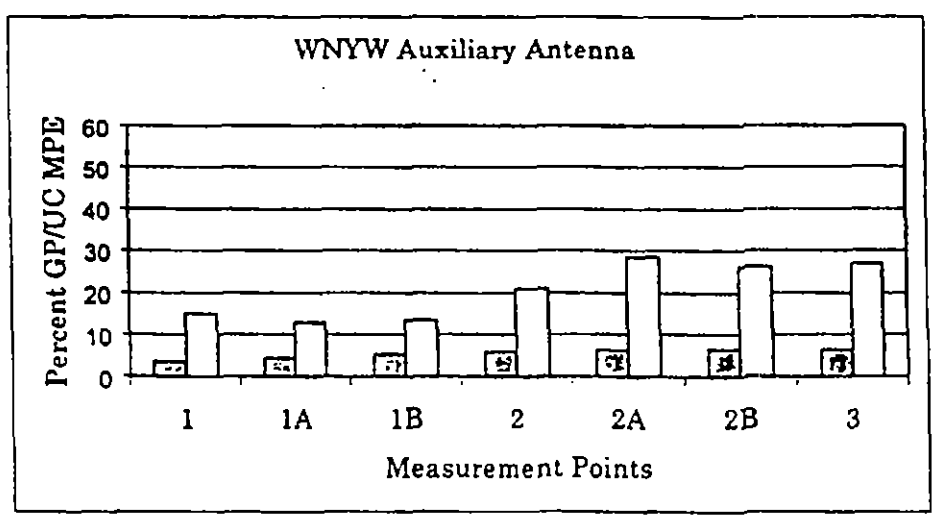
Figure 4
Sheet 2 of 9

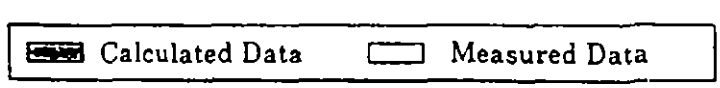






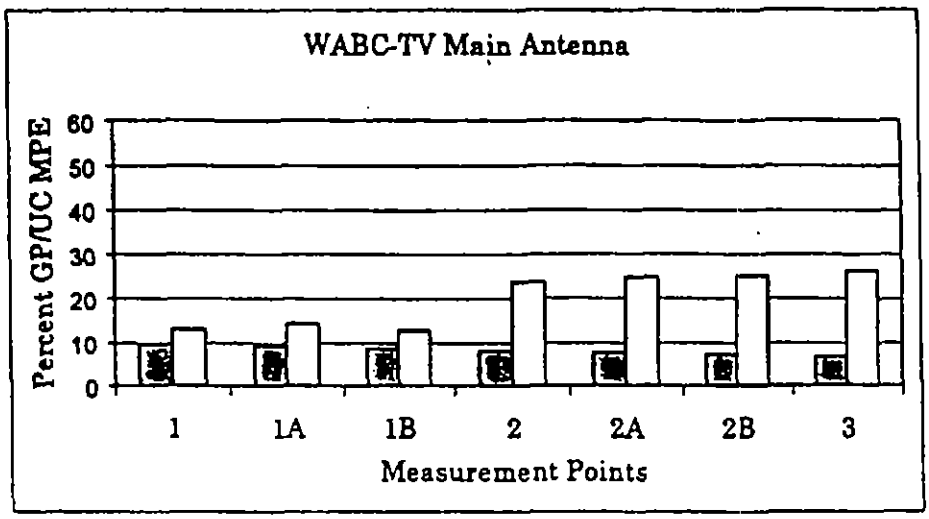

WNYW Main Antenna
Percent GP/UC MPE
60
50
40
30
20
10
0
1
1A
1B
2
2A
2B
3
Measurement Points

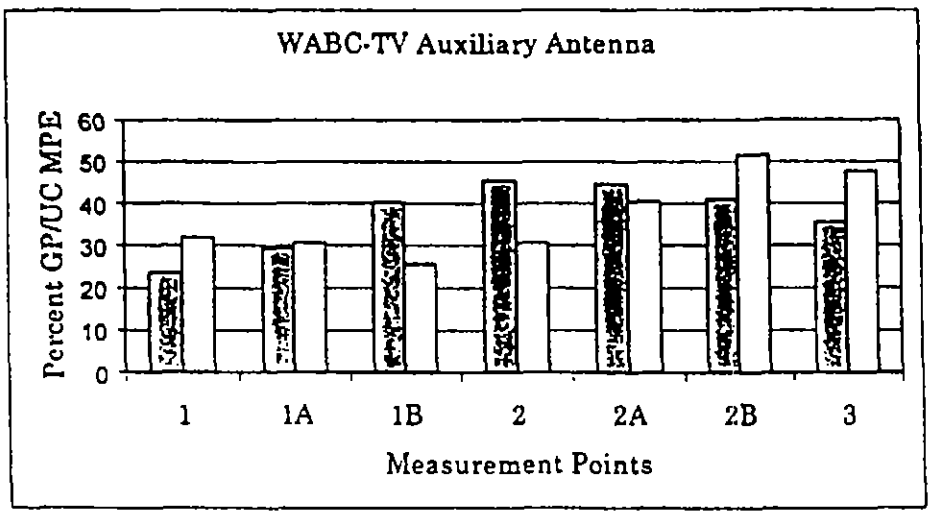

WNYW Auxiliary Antenna
Percent GP/UC MPE
60
50
40
30
20
10
0
1
1A
1B
2
2A
2B
3
Measurement Points

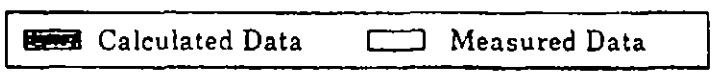

Calculated Data
Measured Data

Graphical Comparison Of Measured And Calculated Exposure Levels

Figure 4
Sheet 4 of 9

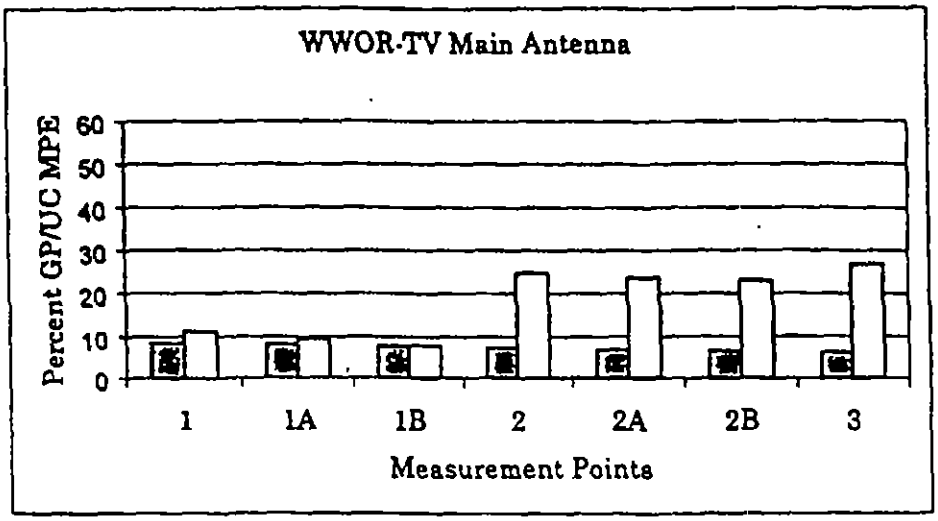


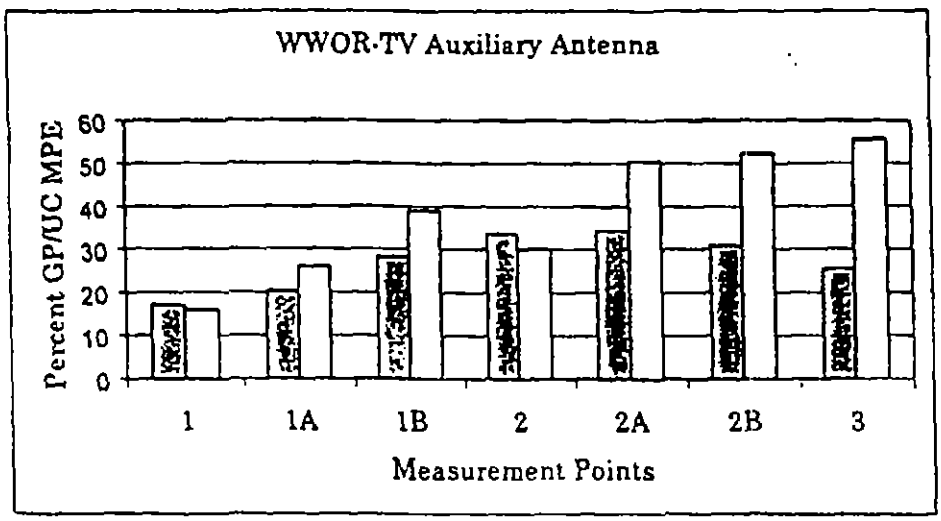


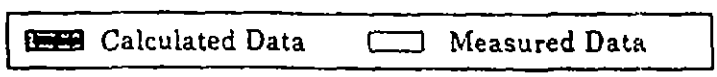


Graphical Comparison Of Measured And Calculated Exposure Levels

Figure 4
Sheet 5 of 9

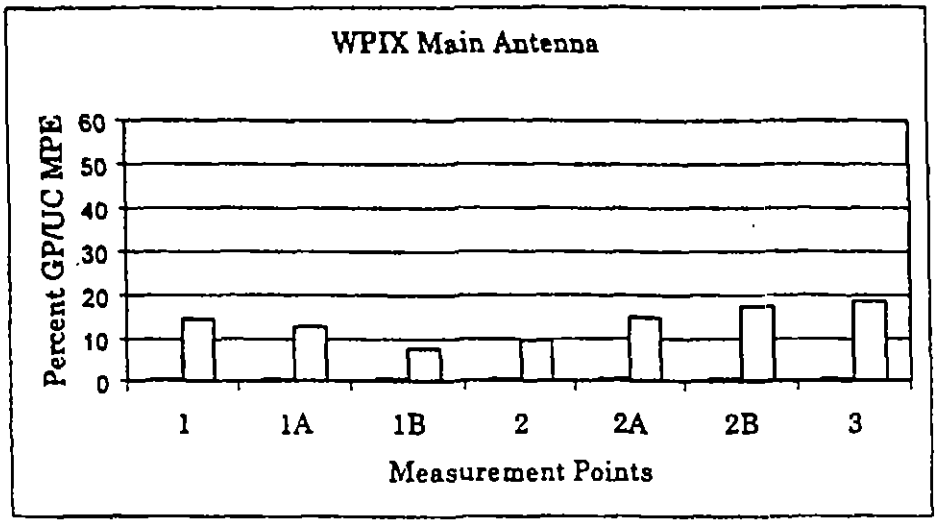


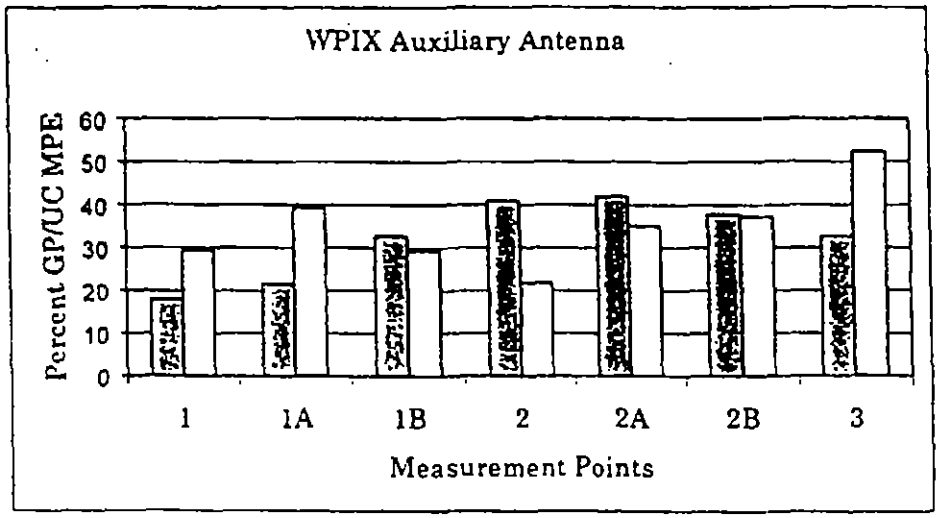


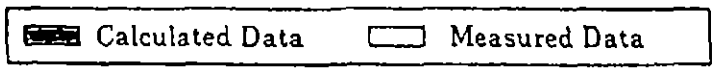


Graphical Comparison Of Measured And Calculated Exposure Levels

Figure 4
Sheet 6 of 9

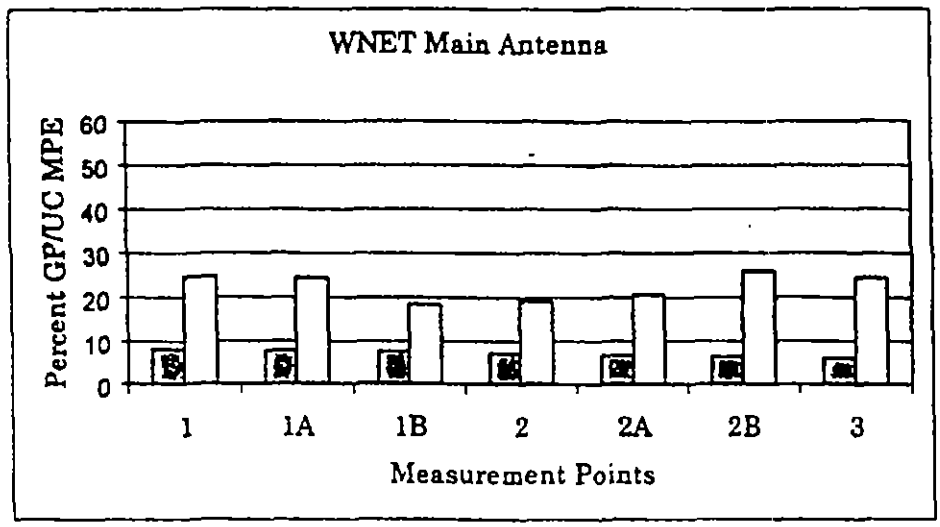


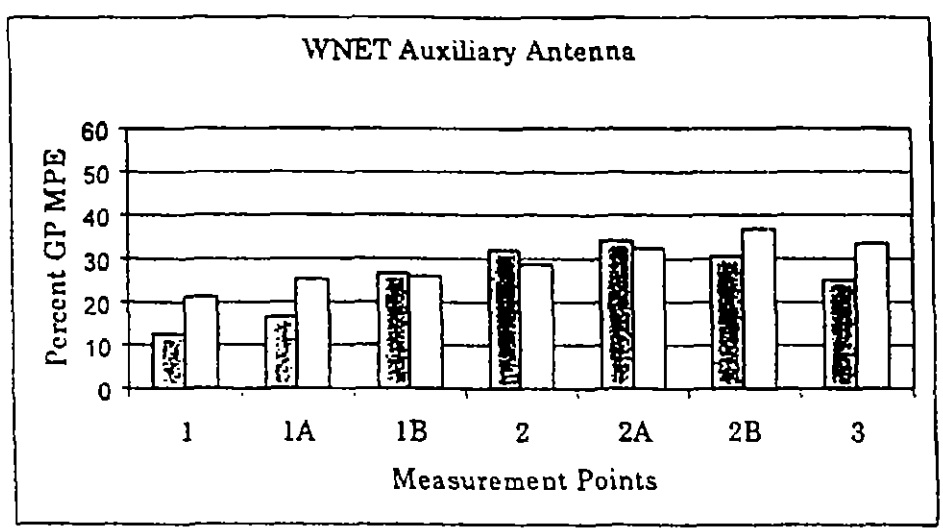


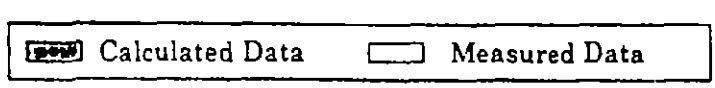


Graphical Comparison Of Measured And Calculated Exposure Levels

Figure 4
Sheet 7 of 9

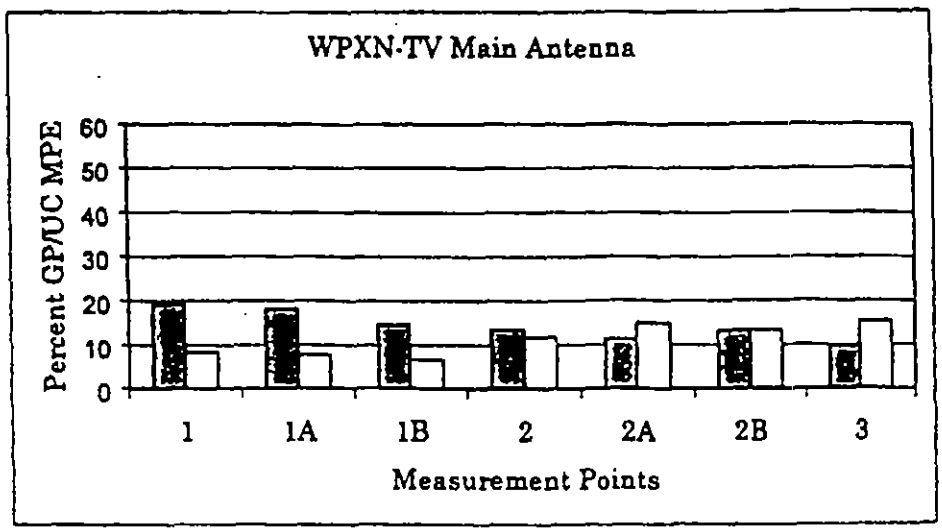


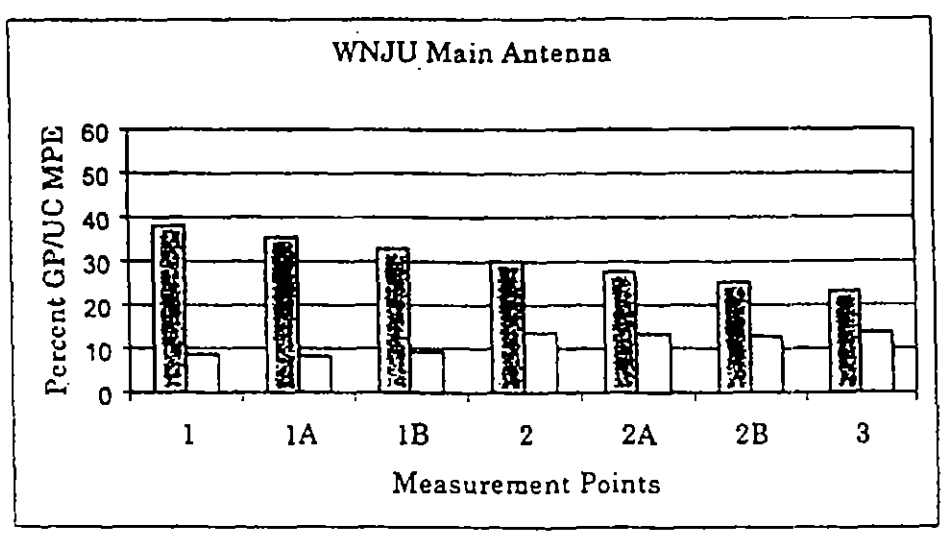




Graphical Comparison Of Measured And
Calculated Exposure Levels

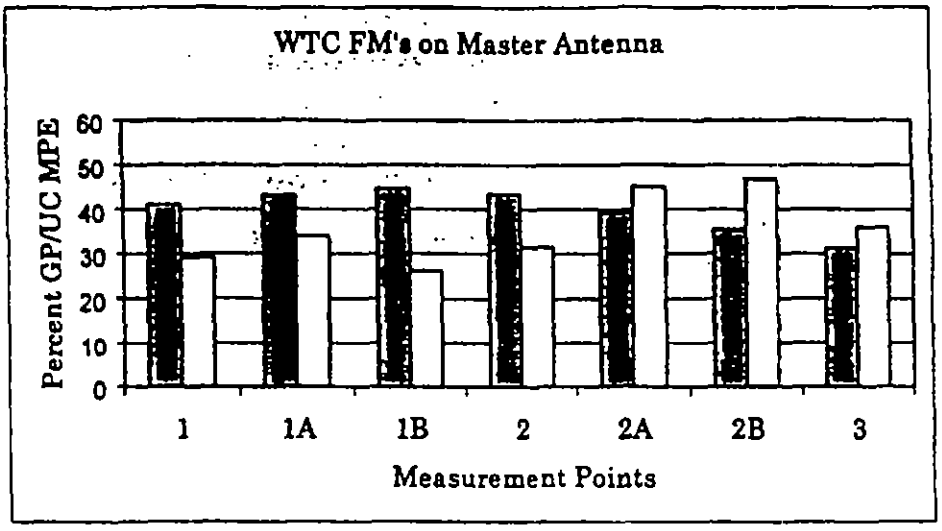
Figure 4
Sheet 8 of 9





Graphical Comparison Of Measured And
Calculated Exposure Levels

Figure 4
Sheet 9 of 9



APPENDIX B

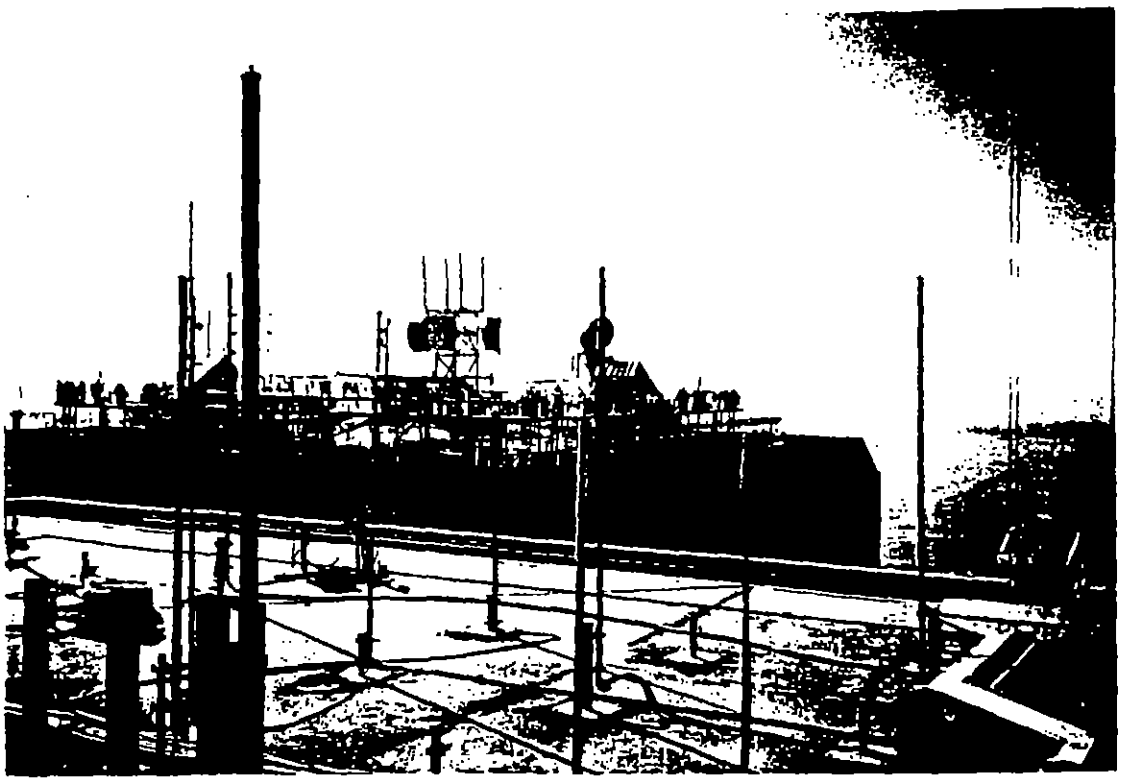


Photo #1: Roof of One World Trade Center
with Two World Trade Center in background.

ATTACHMENT 9

Heitmann & Associate Curtain Wall Evaluation

HEITMANN & ASSOCIATES, INC.
BUILDING ENCLOSURE CONSULTANTS
HONG KONG • NEW YORK • ST LOUIS

EXECUTIVE SUMMARY

Two World Trade Center
New York, New York

Curtain Wall Evaluation
6 November 2000

The results of our on-site evaluation of the current condition of the curtain wall system on the Two World Trade Center project is summarized as follows.

Having been regularly maintained and inspected the general condition of the curtain wall on the tower is relatively good. The curtain wall system appears to be structurally sound and generally air and water tight. The main issues of concern relate to the external appearance of the curtain wall and the ongoing maintenance program that is currently in place.

The original finish on the curtain walls is a clear or natural anodize with a clear lacquer top coat. Over the years the top coat has begun to peel causing a blotchy appearance and the anodized finish has stained and discolored at different rates resulting in a patchwork appearance. One option for improving the appearance of the tower is to repaint the aluminum surfaces of the curtain wall in the field. While minor areas of deterioration of the aluminum has been reported, the primary need for refinishing is to improve the appearance of the tower.

The maintenance program is designed to address issues of water leakage, sealant deterioration, gasket deterioration, component deterioration/failure and any other issues noted during the inspection process. Each tower elevation is inspected every four to five years in accordance with the Local Law requirements. Areas of water leakage appear to be minimal and randomly located, indicating no consistent or typical problem. Sealant and gasket deterioration are dealt with on an "as needed" basis. The issue of component deterioration/failure primarily relates to problems with the operation of the automated window washing system that has resulted in deterioration/failure of the fasteners that fix the window washing platform guide track to the curtain wall system. Recent inspection reports indicate that modifications made to the window washing system appear to have alleviated the problems.

Given the age of the sealants and gaskets it is likely that spot replacement/repairs will continue to be necessary until ultimately all the areas have been replaced or repaired. Thus,

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WWW.HEITMANNASSOC.COM • HeitmannNY@AOL.COM

it would be appropriate to consider addressing all sealant and gasket issues in one comprehensive remedial program covering all of the tower. This would be a major undertaking on a project of this size. Once it is proven that the modifications to the window washing system have been affective in eliminating the damage to the track fasteners, any remaining repairs to the track or its fasteners could also be incorporated into the comprehensive remedial program.

Our full report will address these issues in greater detail.

Respectfully submitted,
HEITMANN & ASSOCIATES, INC.

William G. Young

William G. Young
Manager, East Coast Office

Project :	**Two World Trade Center** New York, New York
Project Number:	20063.00
Observation Dates:	Various dates between September 13, 2000 and October 25, 2000
Report Prepared By:	William G. Young

Heitmann & Associates, Inc. has performed an on-site evaluation of the current condition of the curtain wall system at the Two World Trade Center project. Our evaluation has included the review of the original project construction drawings (as provided on CD ROM.), review of the mock-up shop drawings for the curtain wall system, review of curtain wall inspection reports provided by the Port Authority of New York and New Jersey, interviews with the Building Engineers and visual inspections. The visual inspections were made from the street/plaza level using binoculars, the main roof, setbacks (at levels 7, 41, 75 and 108), and random interior locations of both finished and unfinished spaces. No drops were made using the building's exterior maintenance platform. Our comments and observations noted during the evaluation are summarized as follows.

(Note: All photographs are provided to indicate/clarify typical conditions and may depict conditions from either One or Two World Trade Center.)

I. General Project Description

A. The project Architect was Minoru Yamasaki & Associates with Emery Roth & Sons P. C. of New York City. The construction of the project was completed in approximately 1975. The curtain wall system was designed and installed by Cupples Products of St. Louis, Missouri. Cupples Products is still in operation under a new organization.

B. The curtain wall system consists of vertical strip windows set between tightly spaced aluminum clad building columns (Refer to photographs 1, 2 and 3). Within the vertical strip windows, aluminum spandrel panels occur at each floor line. Aluminum panels are used to clad the four chamfered corners of the tower and the sloped parapet of the main roof (Refer to photograph 3). The finish on the curtain wall framing, aluminum column cladding, corner panels and parapet panels is a clear or natural anodize. The finish on the spandrel panels is darker and could be a light bronze anodized finish.

C. The vision glass is 1/4" thick with a light grey or bronze body tint. The glass is secured/sealed to the framing with neoprene glazing gaskets at both the interior and exterior side.

D. At the typical floors the interior side of the building columns are finished with vermiculite plaster fireproofing with a plaster finish coat. At the mechanical floors (levels 7/8, 41/42, 75/76 and 108/109) the vision glass and spandrel panels are deleted to allow air flow to and from the louvers set behind the line of the curtain wall. The building columns are fully clad in aluminum at these locations (Refer to photograph 4). The gap between the curtain wall and building structure is sealed with an aluminum parapet cap at the bottom and aluminum soffit panels at the top. The concrete walking surface between the curtain wall and the louvers is waterproofed. Additional decorative trim is added to the face of the column cladding to provide added depth to the system (Refer to photograph 2).

E. The sloped parapet panels at the top of the tower are primarily decorative as the concrete slabs and roofing system below provide the main water barriers (Refer to photograph 5). The parapet panels are supported by steel framing anchored to the building the structure. The steel framing is exposed to the weather.

F. The basic curtain wall design is maintained throughout the height of the tower. The appearance of the curtain wall at the mechanical floor and the top of the tower is modified by changing the width of the column cladding and adding components to increase the depth of the system. The curved elements at the top of the tower are add-on members (appliques) that serve no structural purpose (Refer to photograph 3). The base of the curtain wall provides large expanses of glass by combining three typical building columns into one (Refer to photograph 6).

G. The glass panels are cleaned by a robotic washer that is lowered from a roof car (Refer to photograph 7). The robotic washer is guided by stainless steel tracks set into a recess on the face of the column cladding. The roof car can access the full perimeter of the tower via a system of rails and turntables mounted on the roof. The roof car also incorporates a maintenance platform for retrieving the robotic washer should it become inoperative. The maintenance platform is also used to inspect and maintain the curtain wall system.

II. Document Review

A. Curtain Wall Shop Drawings for the Mock-up

1. The curtain wall is a stick built system that incorporates an overlapping section between the bottom of the spandrel panel and the top of the vision glass at each typical floor level (Refer to detail on sheet SK-1). Similar to a modern stack joint, the overlap section serves as a back up gutter for the system and provides a location to accommodate thermal movement of the curtain wall and building structural deflections. The overlap section extends through the column cladding panels at the same location. It appears that the vision glass pockets are weeped (drained) through the open joint at the bottom of the spandrel panel (i.e., the overlap section). Flashing like

deflectors are provided at the top of the overlap section to direct water draining down the inside of the curtain wall or the face of the building structure into the overlap and out the open joint.

2. The aluminum spandrel panels are captured within a glazing pocket on three sides (i.e., the top and both vertical edges) (Refer to detail on sheet SK-2). The bottom edge is left open for drainage of the overlap. The drawings appear to indicate that the spandrel panel is prevented from slipping downward only by the friction of the glazing gaskets at the three captured edges.

B. Inspection Reports

1. In compliance with Local Laws 10 and 11, the Port Authority of New York and New Jersey maintains a program of regular inspections for the curtain wall system. The inspection and repair procedures which appear to be very thorough were developed by Leslie E. Robertson Associates, R.L.L.P (LERA) Consulting Structural Engineers. Leslie E. Robertson was one of the original structural engineers for the project. The inspections are performed by staff of ABM, the building maintenance contractor, in conjunction with a LERA engineer. The inspection program concentrates on one elevation of the tower each year. Thus, in order to fulfill the requirement to inspect the entire building once every five years the inspections are virtually a continuous process. Presently, the physical inspections do not include the panels at the chamfered corners of the tower as these areas are not accessible with the existing work platform. The Port Authority has recently had a special platform designed and constructed for inspecting and maintaining the tower corner panels. The installation and testing of the new platform are scheduled to be completed by the end of this year. Once the new platform is commissioned, physical inspections of the tower corner panels will begin next year. The main issues currently being addressed by the inspections are summarized as follows.

   a. Condition of sealant joints.

      (1) Failed sealants are marked for replacement.

   b. Damaged column cladding.

      (1) Holes and dents in the column cladding are marked for repair. The reports that we reviewed did not indicate the specific cause for the dents or holes in the column cladding. While it is indicated that the holes may be a result of corrosion, there is no indication as to what may have caused the corrosion. A likely cause would be a dissimilar metal in contact with the

aluminum. Based on the inspection reports these conditions appear to be very isolated.

c. Guide tracks for the robotic window washer.

(1) The guide tracks are checked for a variety of conditions including; damage to the track, misalignment between track sections, elongated fastener holes in the track, and loose, damaged or missing fasteners. See additional comments in paragraph II.B.3. below.

d. Spandrel panel position/attachment.

(1) As noted above, it appears that the original design relied on friction to secure the spandrel panel in the correct position. The LERA reports mention lower corner support castings and fixing screws for securing the spandrel panel to the jamb frame. Neither the support castings nor the fixing screws are shown on the shop drawings that we have reviewed. The shop drawings do show castings at the bottom corners of each spandrel panel that are used to cap the jamb extrusions and provide alignment with the jamb extrusions above. There is no indication that the castings are intended to support the spandrel panel. It is possible that the design was changed following the mock-up test. However, without reviewing the project shop drawings it is not possible to determine if the design was changed. Regardless of the design intent, we agree that LERA's remedial recommendation to add a screw to fix the spandrel panel to the jamb extrusion is correct.

e. Attachment of column cladding projections and appliques.

(1) The column cladding projections and appliques are checked for loose/missing fasteners and loose/missing splice plates and connection plates.

2. The conditions noted above are generally repaired on a spot basis following each inspection depending on how critical a situation is relative to safety or performance of the curtain wall system. Thus, issues relating to aesthetic concerns may not be repaired immediately.

3. As the inspections and repair work have progressed over the years, the number of issues needing attention has generally been on the decline. The most significant issue has been related to guide tracks for the robotic window washer. Initially the operation of the robotic window washer was damaging

the guide tracks and the fasteners that attached them to the column cladding. Improvements developed by LERA for the guide system on the robotic wind washer appear to have significantly reduced or eliminated the damage being caused to the guide track and its fasteners. However, there are still repairs to be made to areas of previous damage.

III. Interviews

A. Discussions with Port Authority of New York and New Jersey personnel as facility managers for some of the main tenants indicated that isolated cases of water leakage had occurred in the past and had been repaired. There were no complaints of ongoing water leakage through the curtain wall system. Based on the locations indicated it is likely that at least some of the previous water leakage came through the roofing/waterproofing at the mechanical level setbacks.

IV. Inspections

A. Interior inspections.

1. Random areas of the curtain wall were inspected from the interior of the tower to check for signs of water leakage or other indications of deterioration. Areas were inspected based on accessibility and included both finished and unfinished spaces. Floors 18, 35, 56, and 74 were made available for interior inspections. Our observations are summarized as follows.

   a. No signs of water leakage were noted at any of the finished spaces. At some of the unfinished/unoccupied spaces there was staining and efflorescence noted on the plaster finish at the interior side of the column enclosures (between the vision panels) (Refer to photograph 8). These stains could be the results of water leakage through the curtain wall or condensation that formed on the interior surface. It was reported by Port Authority personnel that during certain conditions condensation did form on the inside surface of the curtain wall. This condition is possible as the curtain wall shop drawings that we have reviewed do not indicate any significant amount of thermal insulation within the system.

   b. As the plaster finish at the interior side of the column enclosures (between the vision panels) is supported by the curtain wall framing it (the plaster) is subjected to the same deflections that occur in the curtain wall system. These deflections have resulted in horizontal cracks in the plaster finish coat (Refer to photograph 9). While the curtain wall framing is typically designed to limit deflections to 1/175 of the span between supports, members supporting a more rigid material like plaster would be designed to limit deflection to 1/360 of

the span or less. At this time cracks appear to be primarily an aesthetic problem that is addressed with spackle and paint when the floors are renovated.

c. A number of locations were noted where the interior glazing gasket had dropped out of its pocket at either the top or side of the vision glass panel. This condition is a result of the glazing gasket having taken a compressive set and lost some of its flexibility. Additionally, the original design may not have had sufficient engagement between the glazing gasket and the window frame. Thus, under a negative wind load the glass is pressed against the outer gasket, compressing it and opening up the gasket pocket on the interior allowing the gasket to drop out. LERA has proposed replacing the gaskets that have dropped out with new gaskets. As the primary function of the interior gasket is to provide a separator between the glass and metal frame, the existing gaskets could be reinstalled using a few small beads of silicone sealant to the gasket in place.

B. Exterior Inspections.

1. The exterior visual inspections were made from the street/plaza level using binoculars, the main roof and setbacks (at levels 7, 41, 75 and 108). Our observations are summarized as follows.

a. In general the curtain wall system appears to be in good structural condition with no obvious signs of failure.

b. The condition of sealant joints visible at the setbacks varied from poor (sealant is dry and hard) to recently replaced (Refer to photograph 10). Replacement of sealants appears to have been done on a spot basis to address specific areas of failure or reports of water leakage. Additionally, joints that were intended in the original design to be left open have been sealed. The open joints are intended as a drainage path for water that enters the curtain wall system in the floor height above. If the system is functioning as designed, water should not be able to enter the open joints and reach the interior of the tower. However, if failure of internal seals or flashings prevents the system from functioning as designed, it may be necessary to seal the open joints to prevent water entry instead of dismantling the system. When sealing the open joints, caution must be exercised to prevent water being trapped within the curtain wall system.

c. The main issue from the exterior is the overall appearance of the tower. Over time the anodized finish on the column cladding, spandrel panels, corner panels, and sloped parapet panels has deteriorated resulting in a patchwork appearance (Refer to photographs 2 and 3). The discoloration is caused by dirt and chemicals in the atmosphere that embed themselves in the porous surface of the aluminum or cause the aluminum to corrode. Additionally, it appears that the anodized finish of the curtain wall, particularly the spandrel panels, was coated with clear lacquer that is now peeling off (Refer to photographs 11 and 12). The areas where the clear lacquer coating has peeled away are very visible from the street/plaza level. It has been indicated by the Port Authority that the curtain wall system was originally supplied with the clear lacquer coating applied over the anodized finish.

d. From the roof level it was noted that the steel framing that supports the sloped parapet panels is lightly rusted (Refer to photographs 13 and 14). The base of the steel framing is supported on a pedestal that comes up from the building structure below. Steel shim plates used between the steel framing the pedestal to adjust the level are severely rusted (Refer to photograph 15). This condition is similar to the deterioration of the shim plates used between the pedestal and roof rails for the window washing equipment (Refer to photographs 5 and 16). At the time of our observations the shim plates below the roof rails were being replaced.

V. Summary

A. Based on our onsite observations and evaluation of the documents, the overall condition of the curtain wall system is generally good. While there are ongoing maintenance issues to be addressed, there do not appear to be any significant structural or waterproofing issues that require attention. Nothing in our observations or evaluations leads us to believe that the condition of the curtain wall will deteriorate significantly in the foreseeable future.

B. The ongoing inspections will need to be continued in some form to fulfil the requirements of the Local Laws. Inspection of the guide tracks for the robotic window washer would likely need to be a high priority until such time that the modifications to the guide system are proven to be affective in eliminating damage to the guide tracks and fasteners.

C. The ongoing maintenance work represents a significant capital outlay each year. The maintenance program could be converted to a remedial program whereby repairs for the known problems are applied to the entire tower, bringing the whole of the curtain wall system up to an equal state of repair. This would mean replacing or modifying components before they actually fail. Given the size of the project, a remedial program of this type would be a substantial undertaking. While this approach would have an extremely high up front cost, it should significantly reduce the cost of and need for ongoing maintenance.

D. Our recommendations regarding the issues noted during our inspections are summarized as follows.

1. Water leakage - As there does not appear to be any significant or typical water leakage problems, we recommend that water leaks continue to be addressed as they are reported. A remedial program that addresses sealant repair and replacement for the entire tower would reduce the potential for future water leakage.

2. Cracked plaster - As the cracks present primarily an aesthetic concern, we do not feel that any specific action is required relating to this issue. The cracks can continue to be addressed as floors are renovated. Should a permanent solution be desired it may be possible to replace or clad over the plaster with drywall or other more flexible material.

3. Interior gaskets - The dropping out of the interior glazing gaskets is a minor issue and can be corrected by reinstalling the existing gasket into the glazing pocket with a few small beads of silicone sealant.

4. Sealant joints - While the overall condition of the sealants is poor due to its age and type, actual failures are isolated. Thus, the sealant could continue to be addressed on an "as needed" basis or all sealants could be replaced as part of an overall remedial program.

5. Aluminum finish - While removal of the deteriorated clear lacquer coat would eliminate the blotches and improve the appearance of the tower, it is likely that the patch work appearance would remain due to differences in the shade of the finish on adjacent components. It is our opinion that cleaning the aluminum finish would not significantly reduce the patch work appearance. An option for improving the overall appearance would be to paint the aluminum components in place on the tower. While this process would be a major undertaking on a project of this size, it has been successfully done on large projects. As this is an aesthetic issue there is no need to do anything with the aluminum finish should the current appearance be accepted. If painting is to be considered, it should be integrated with a program to replace the existing exterior seals within the curtain wall system at the same time.

6. Rusted steel framing - While the rusting of the steel framing for the sloped parapet panels is mild at this point, we recommend that the steel framing be cleaned, primed and painted to prevent further deterioration. The rusting of the steel shims is more severe and should also be addressed. The mild steel shims should be replaced with galvanized or stainless steel shims and the pedestals cleaned, primed and painted.

While our inspections and evaluations have covered a random sampling of conditions, we believe that our findings are representative of the entire curtain wall system. Should any additional information or clarification be required, please feel free to contact our office.

Respectfully submitted,
HEITMANN & ASSOCIATES, INC.

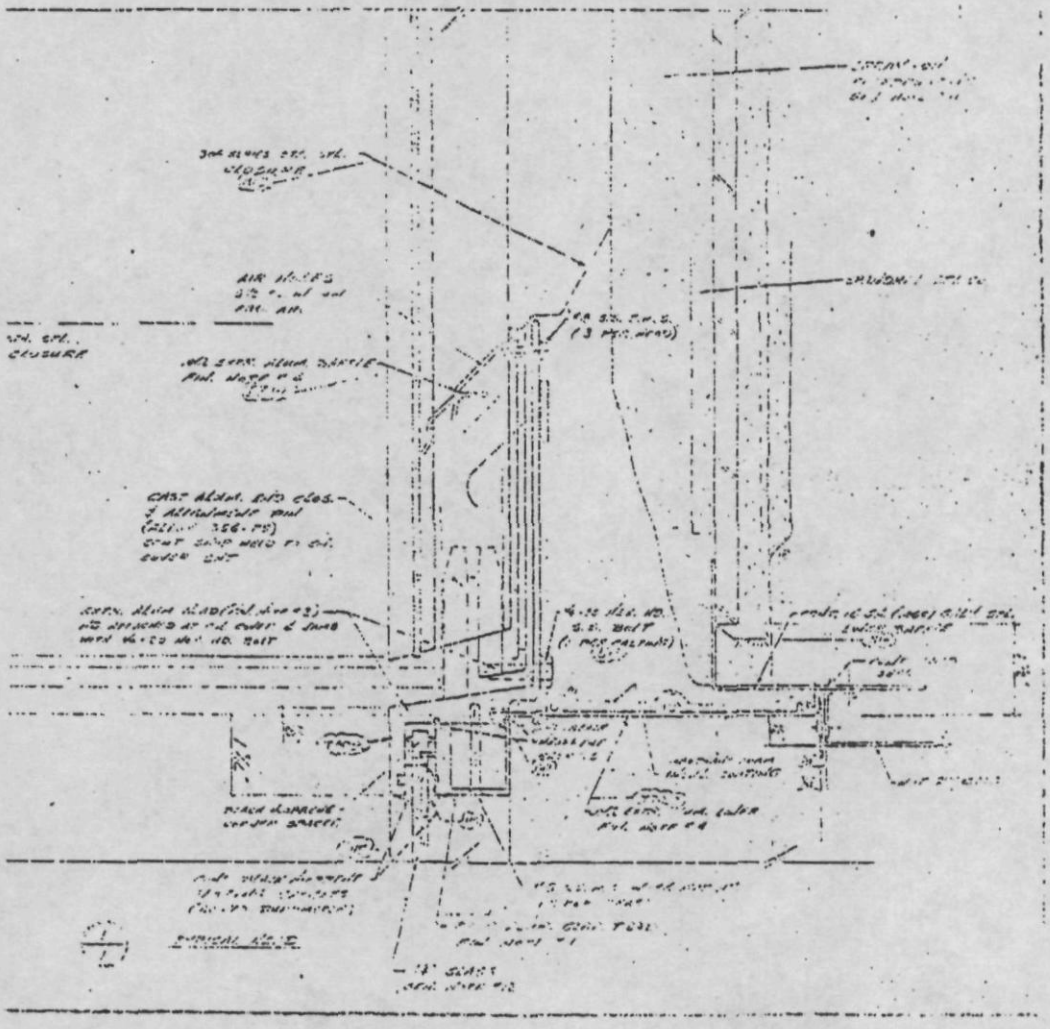
William G. Young

William G. Young
Manager, East Coast Office

Attachments

One & Two World Trade Center

(HAI Project #20063.00)



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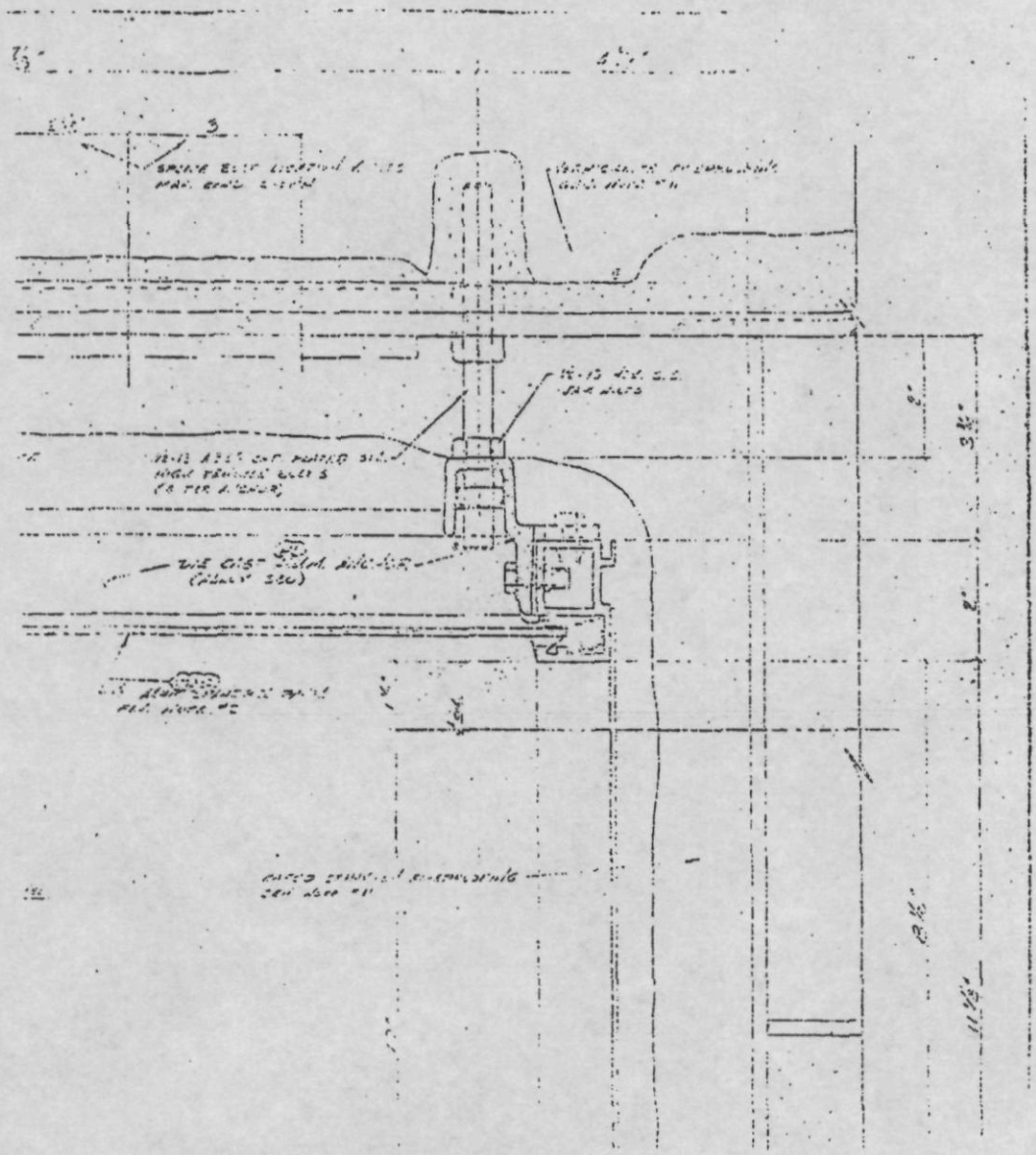

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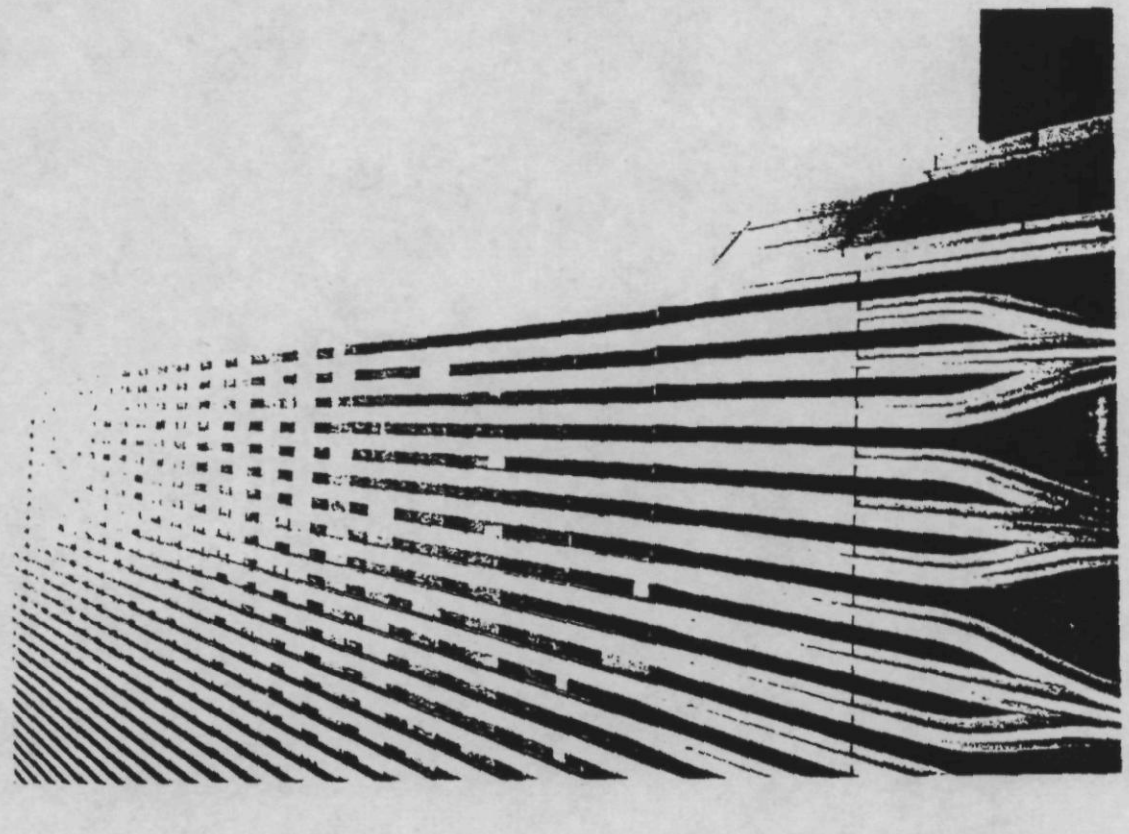

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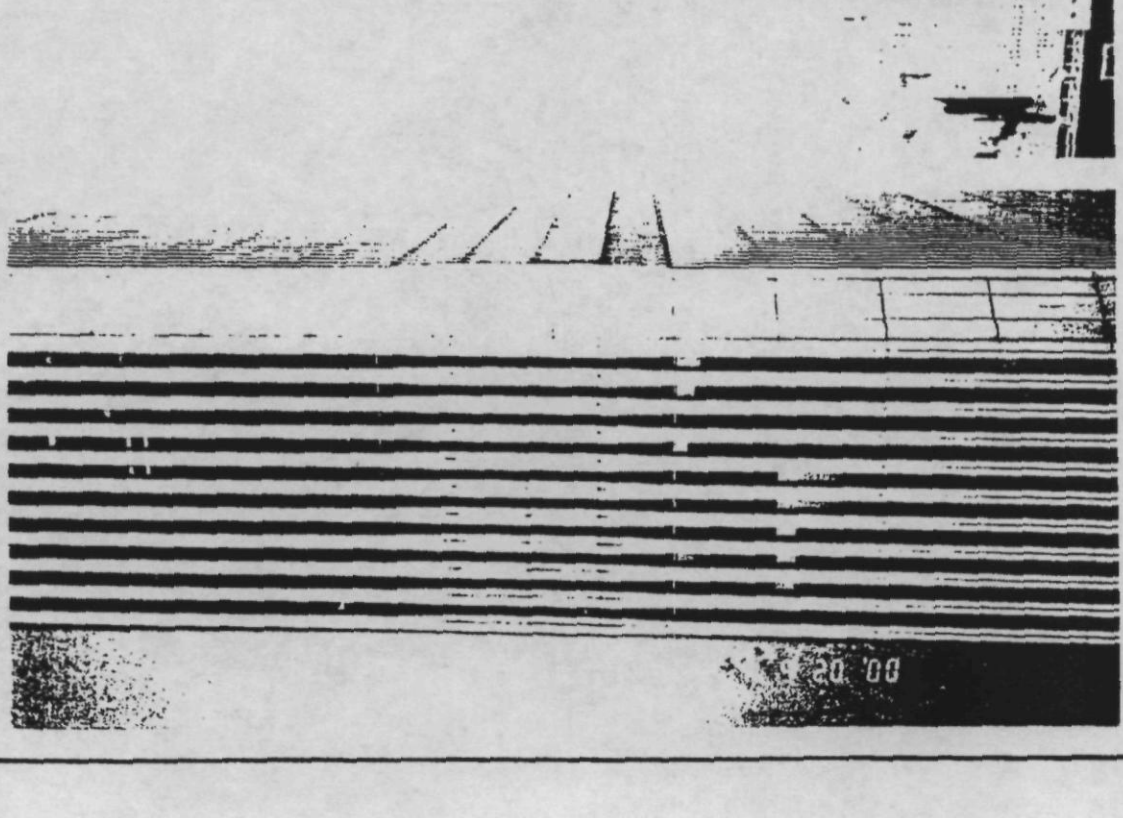

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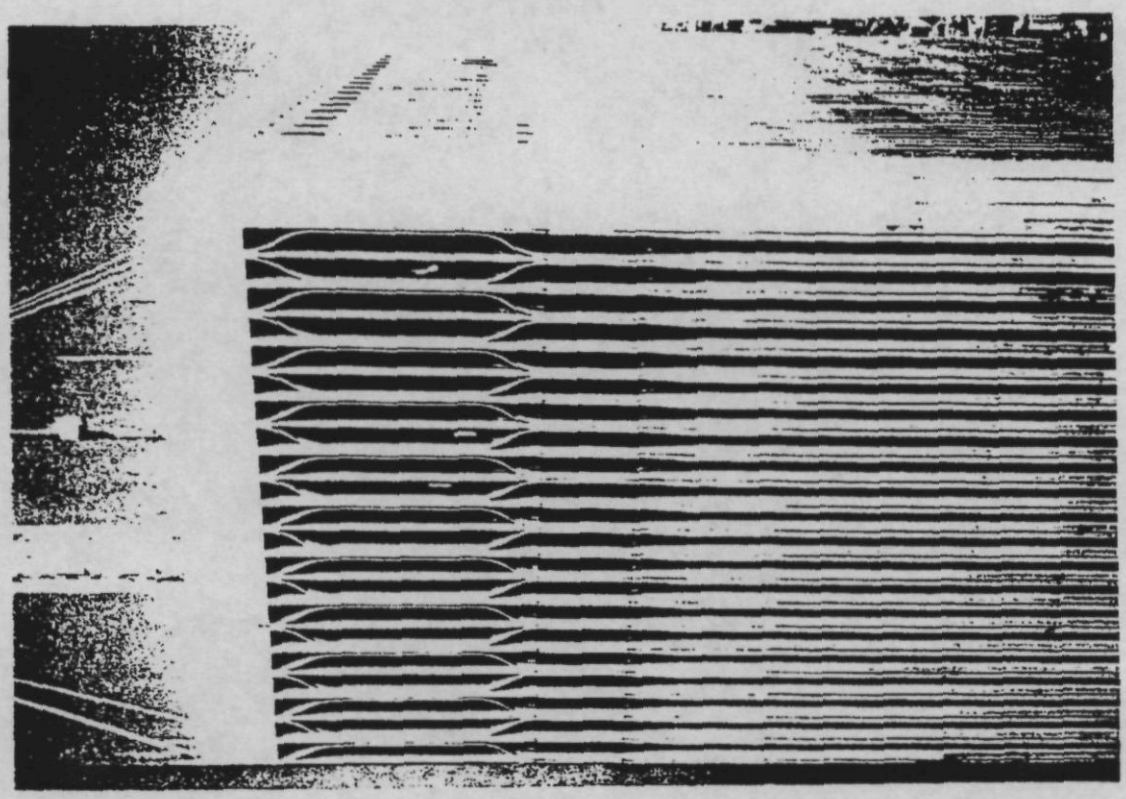

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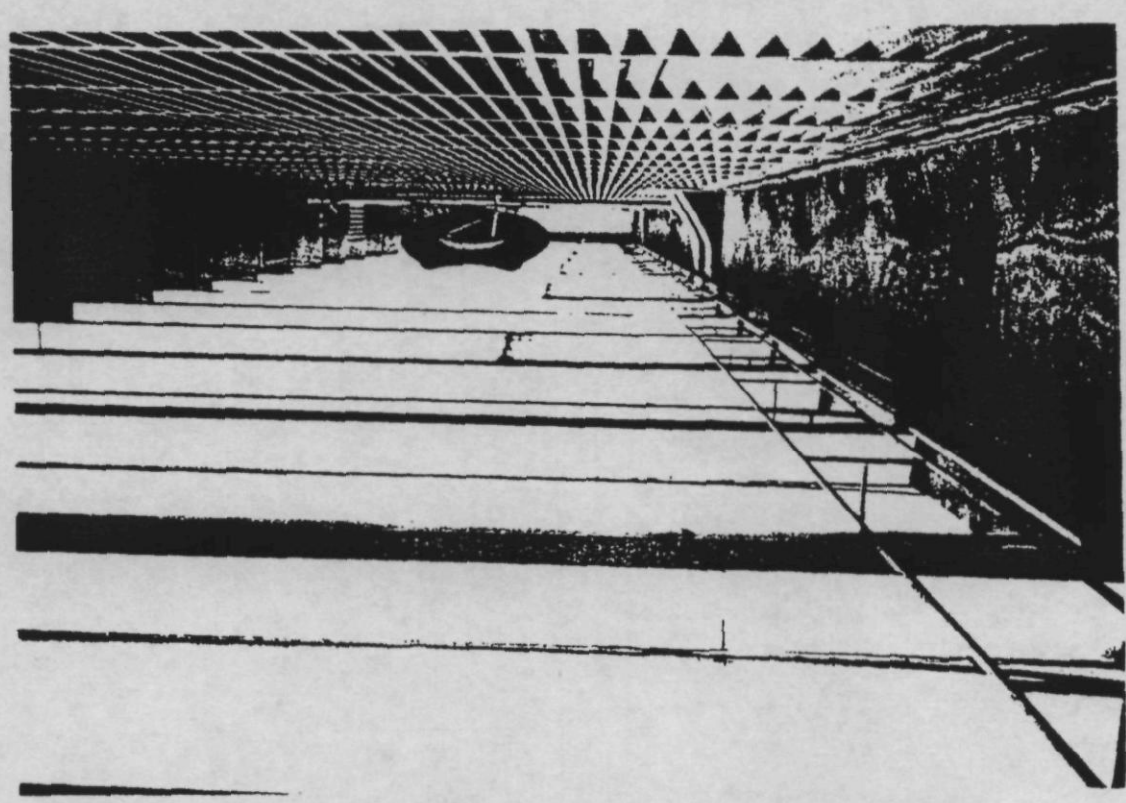

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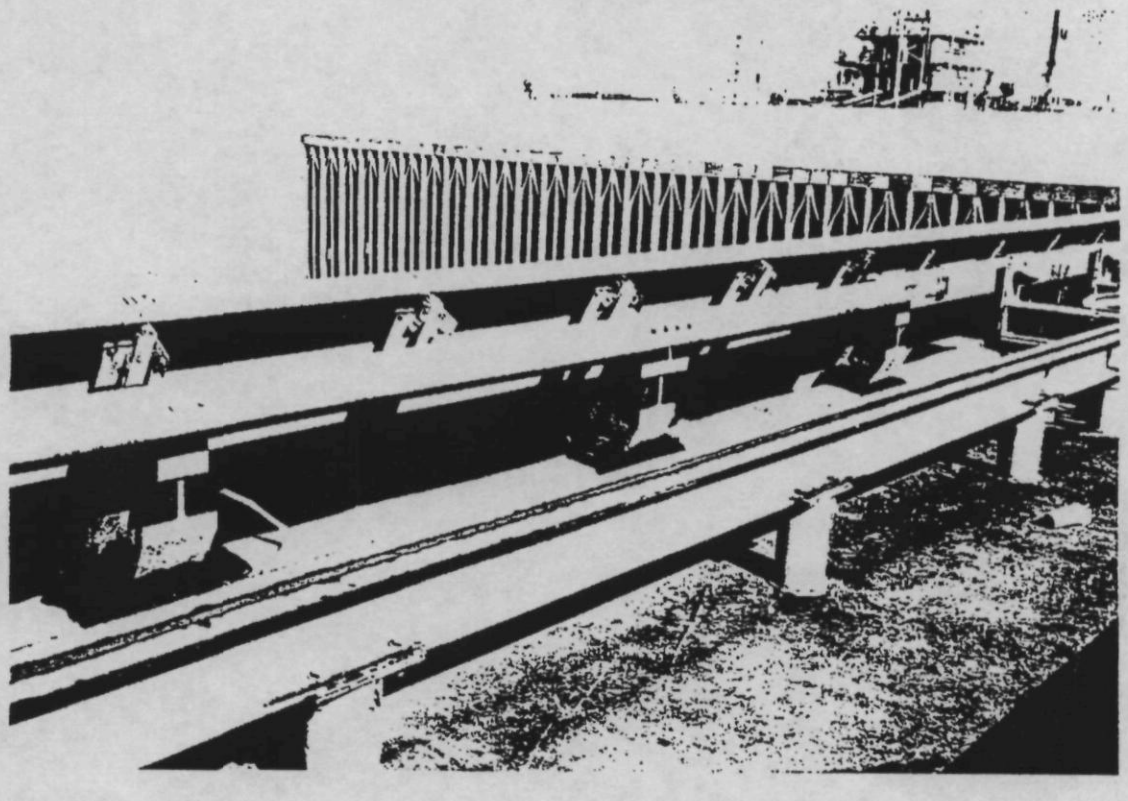

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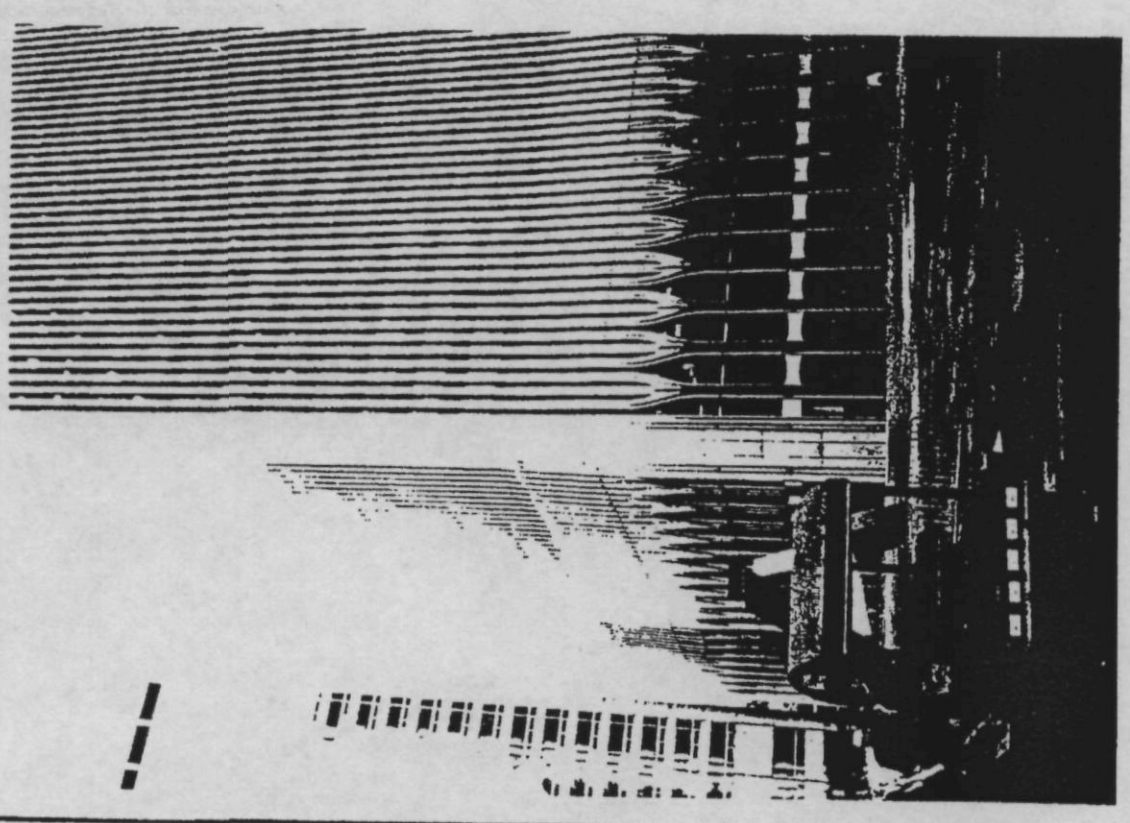

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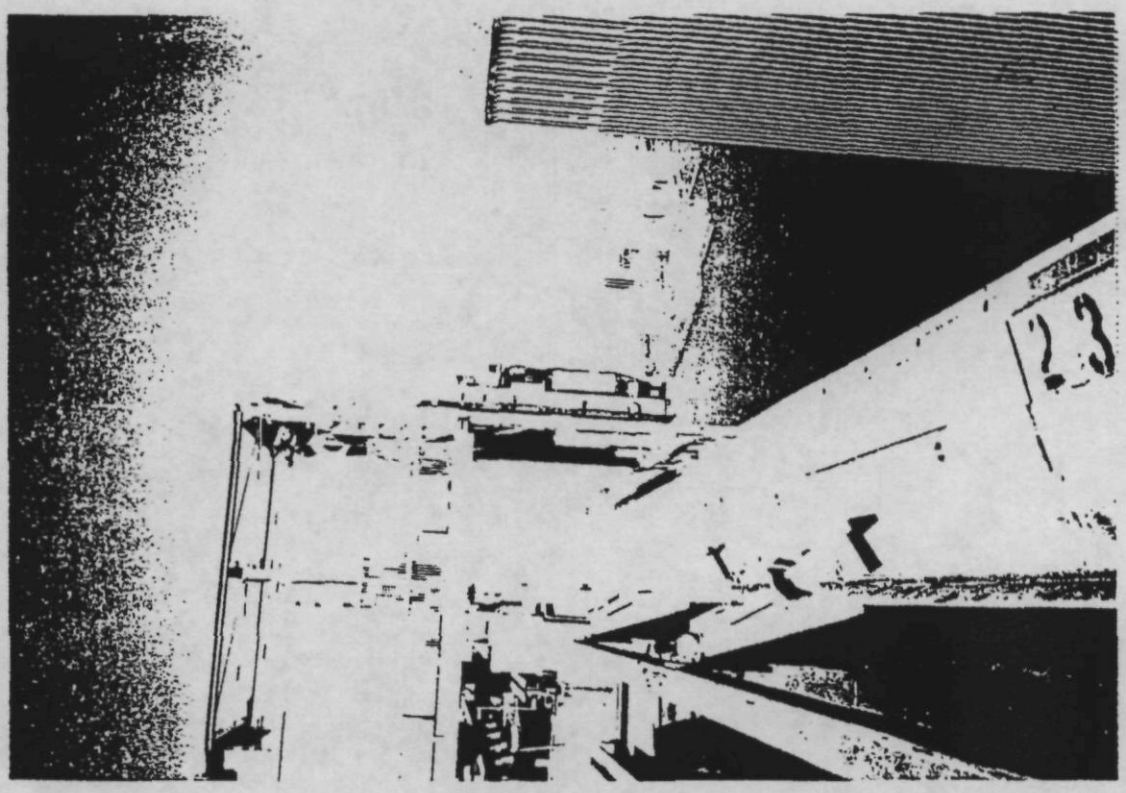

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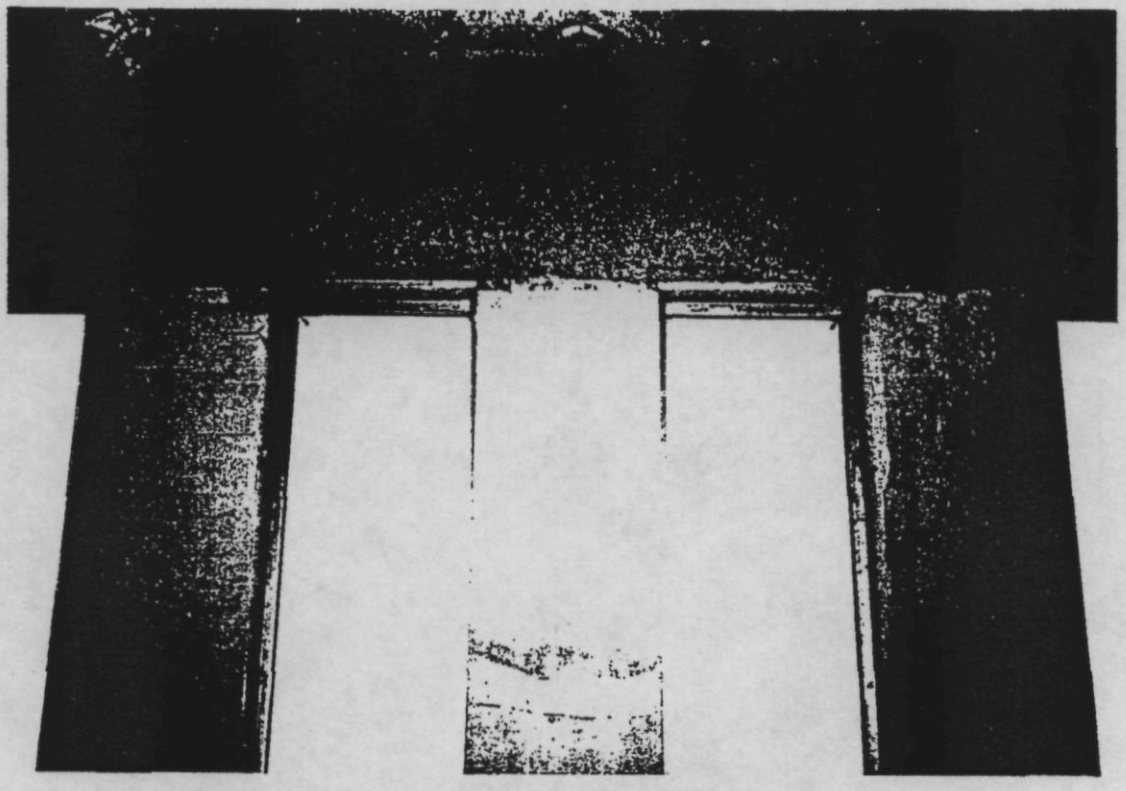

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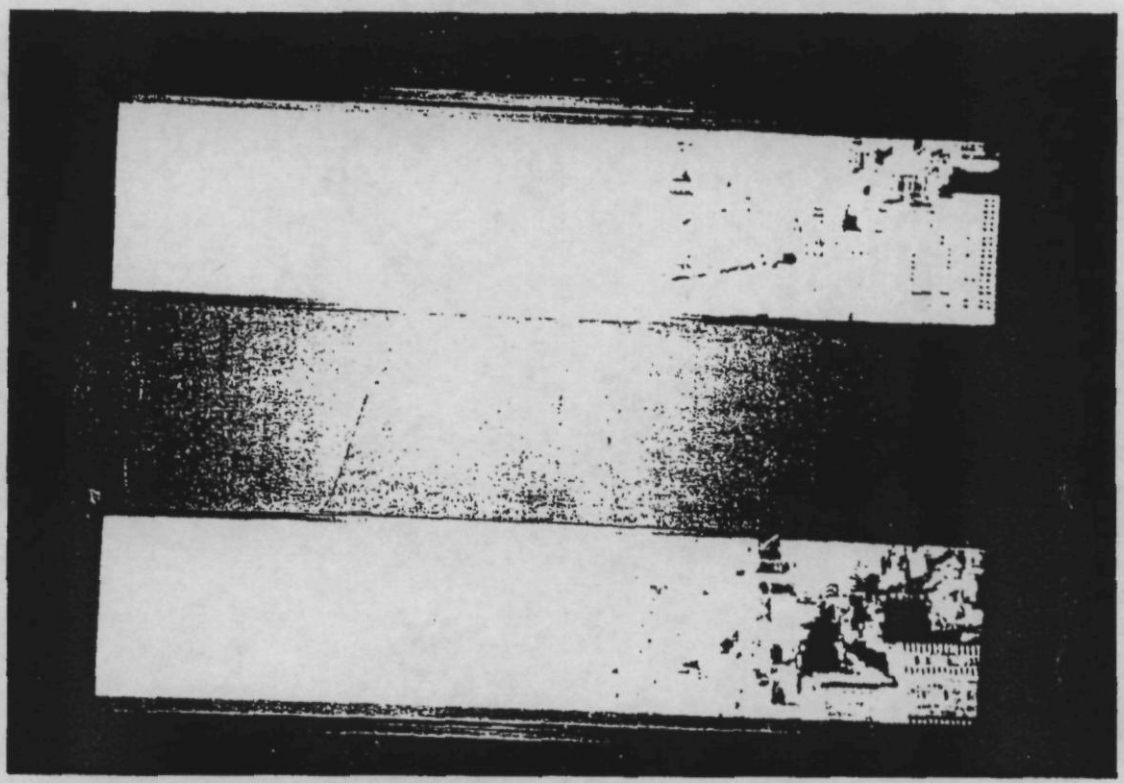

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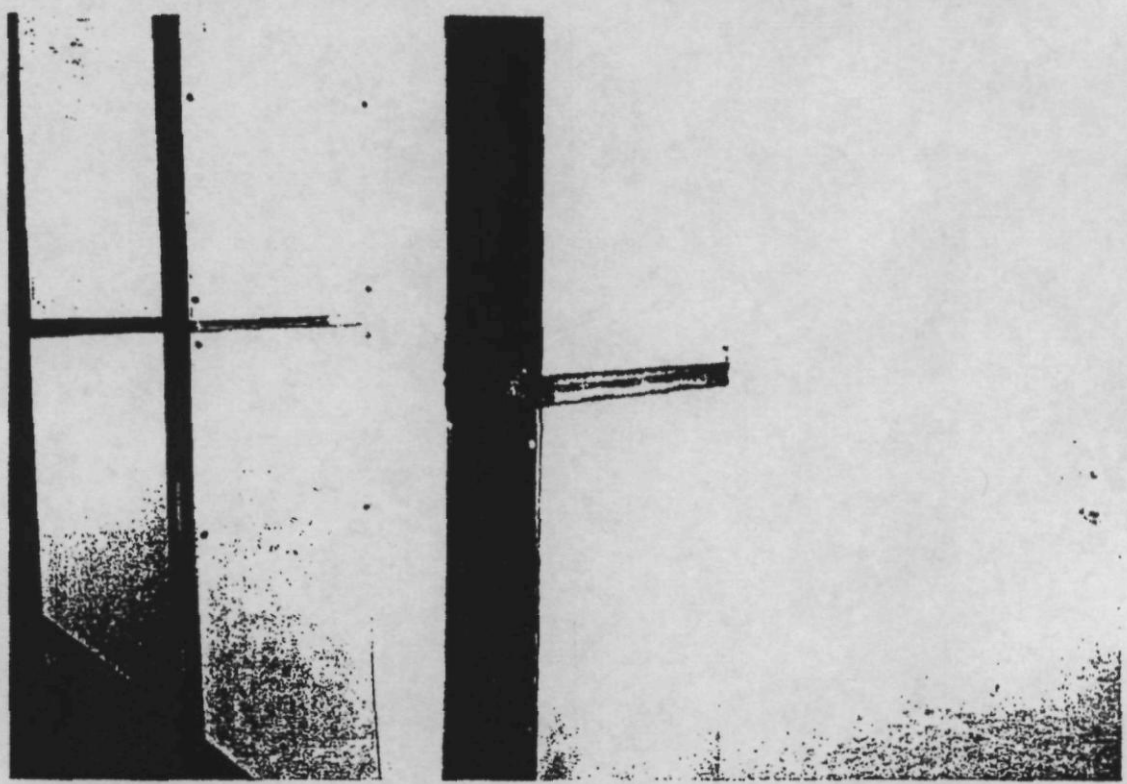

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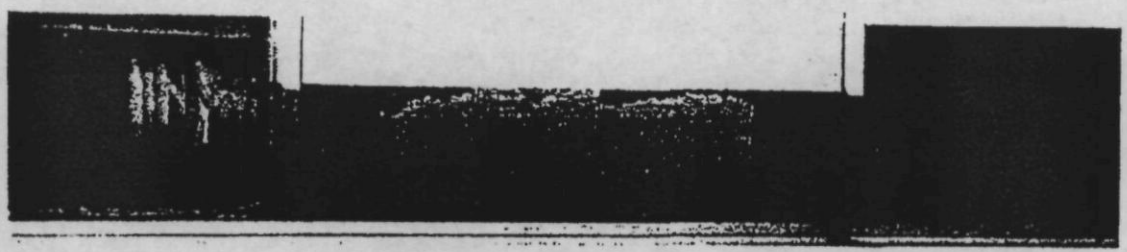

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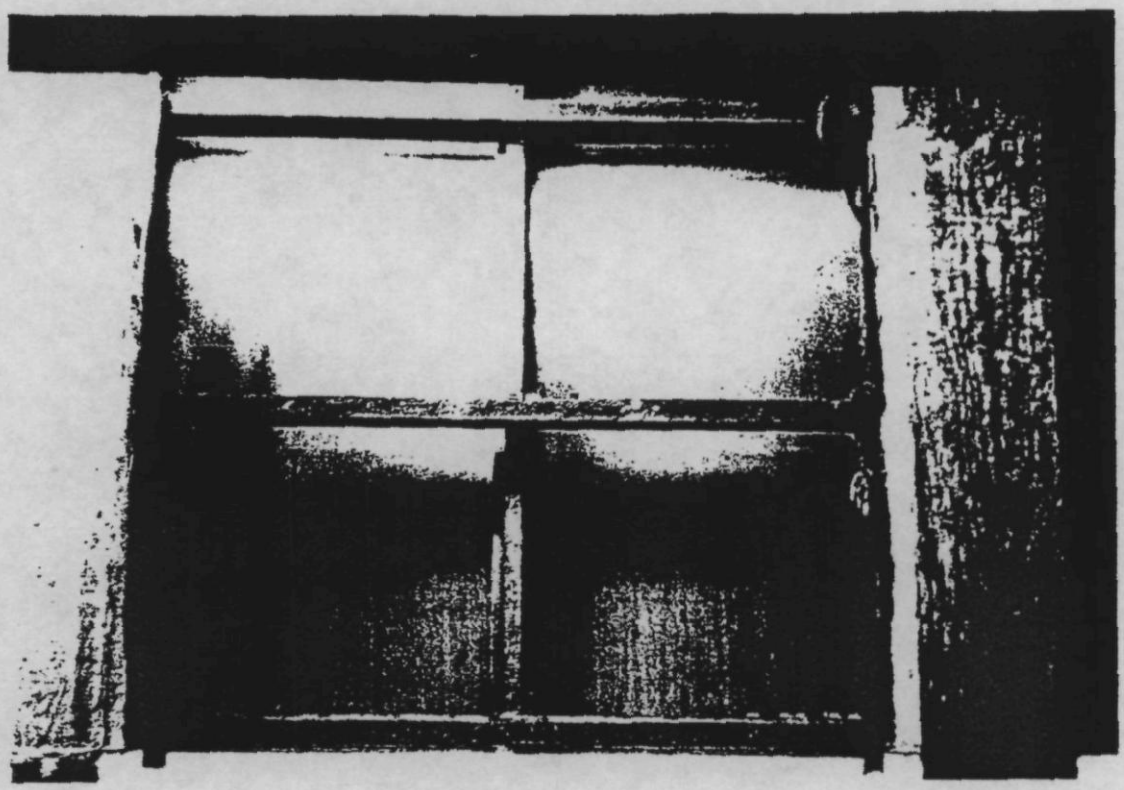

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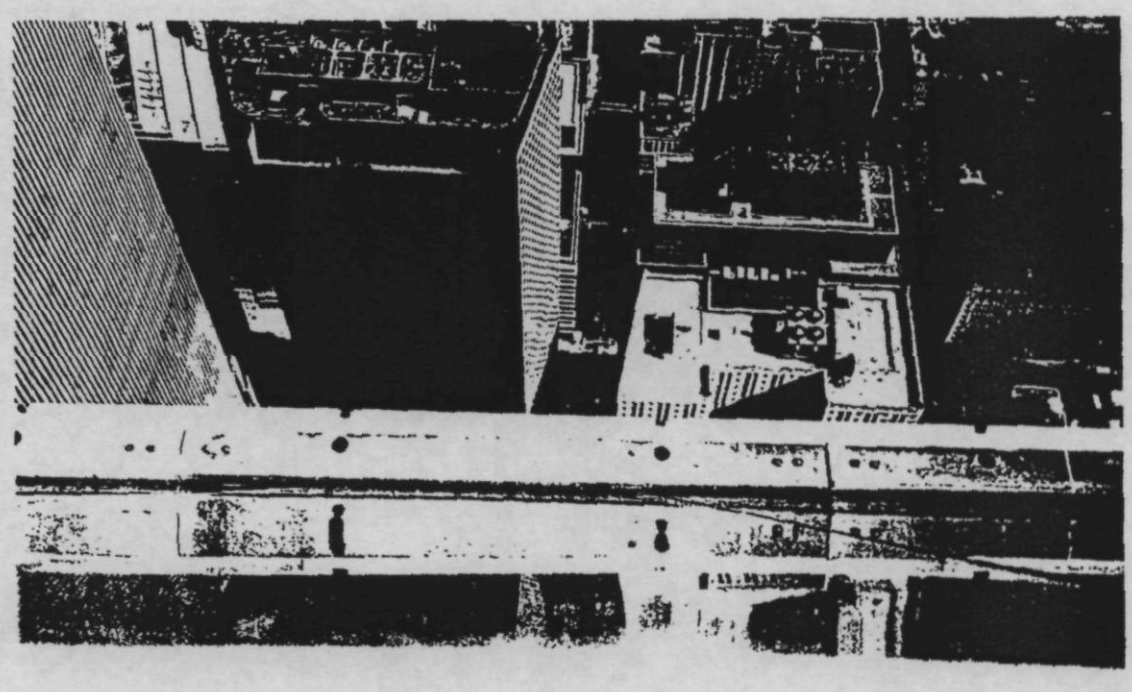

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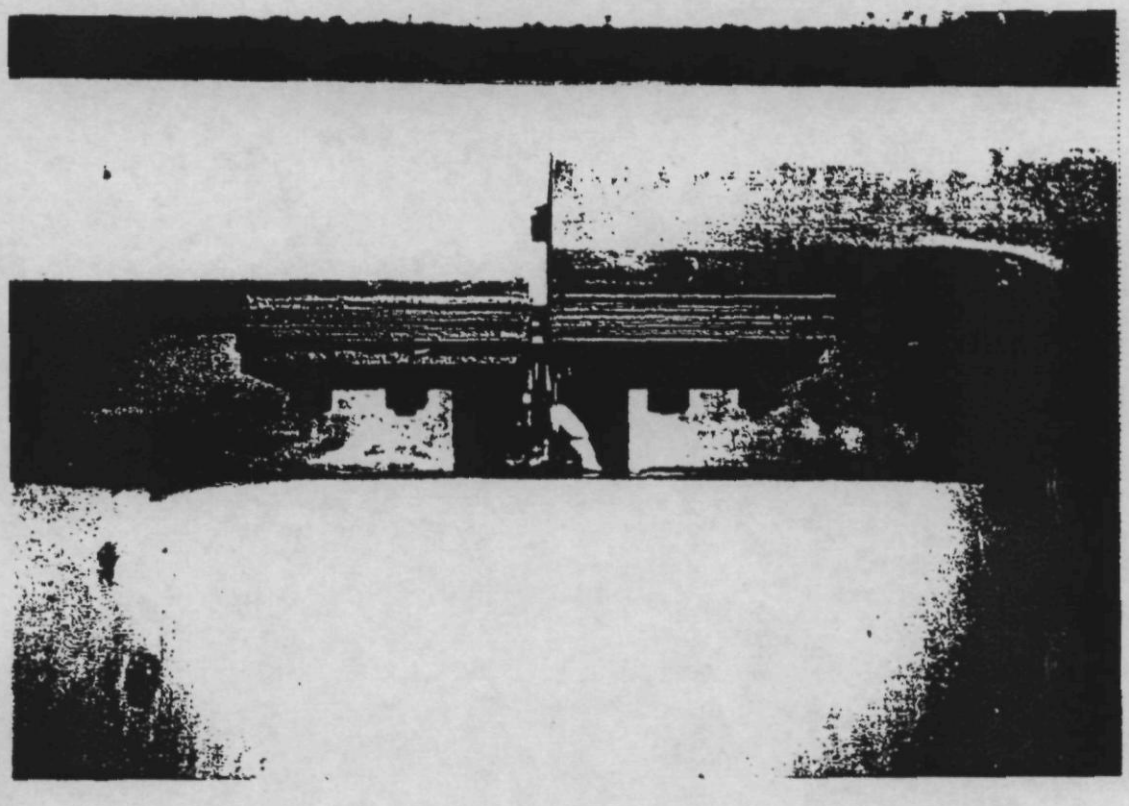

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